THE

DENTAL PRACTITIONER

Journal of Dental Science for the Practitioner

VOL. V, NO. 1 SEPTEMBER, 1954

[Incorporating the Proceedings of the British Society of Periodontology, and the Transactions of the British Society for the Study of Orthodontics]

CONTENTS

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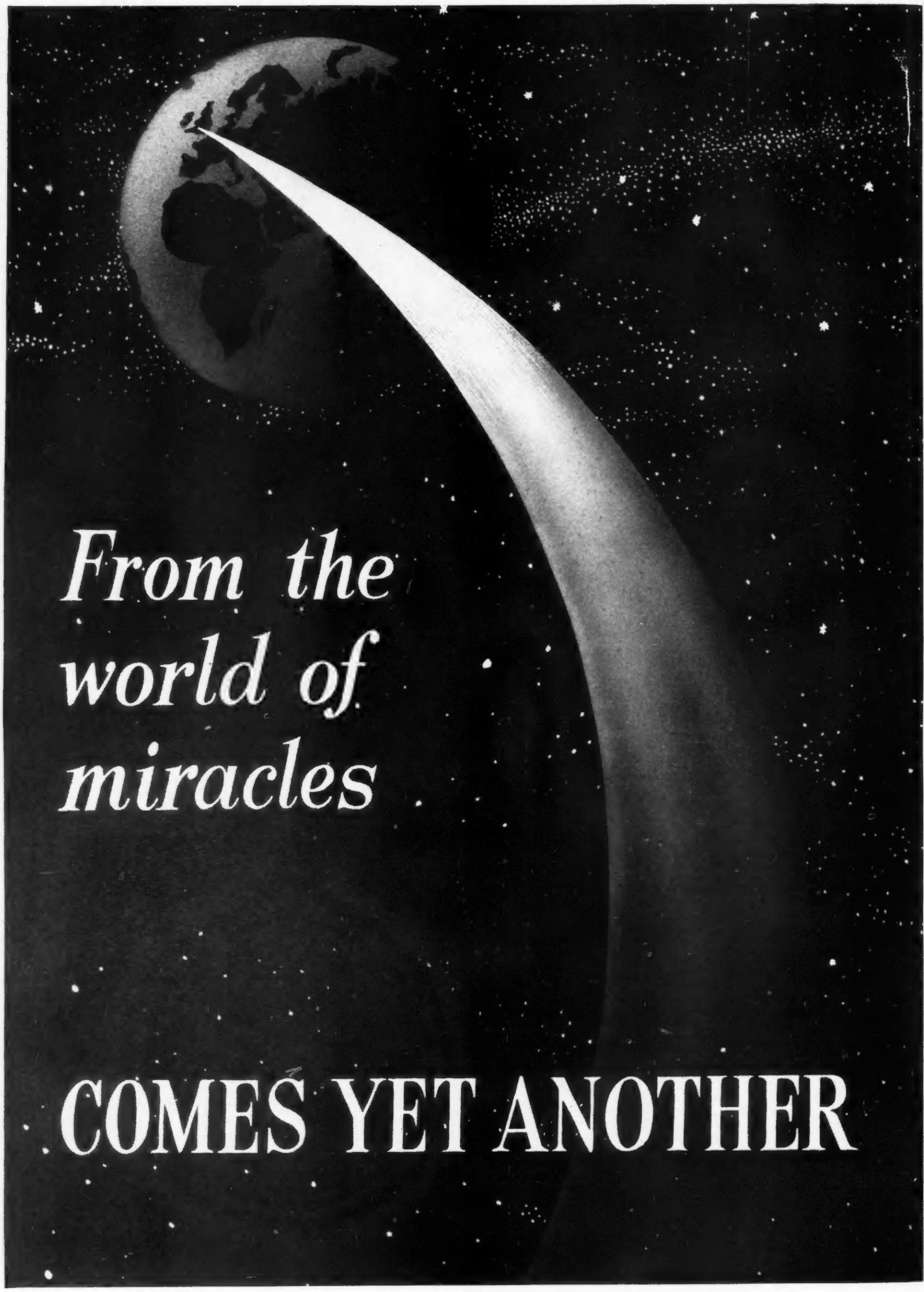
From the world of miracles
COMES YET ANOTHER

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THE

DENTAL PRACTITIONER

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Vol. V, No. 1 **September, 1954**

DITORIAL

THE EXPOSED PULP

An increasing attention is being paid both by the research worker and the clinician into the question of the exposure of the pulp in a tooth. Although not by any means solved, the problem is undoubtedly being slowly clarified. The main difficulty has always been in the treatment of the child—that is with the deciduous teeth and the permanent tooth with an open apex. In the case of the adult with the closed apex and fully formed tooth the choice of treatment has been between extraction and root-canal therapy. This choice is necessary because the tooth with an exposed pulp, however small, will nearly always eventually die, unhappily usually without any trace of signs or symptoms. Nowadays there are a number of techniques for pulp capping the exposed adult tooth in an attempt to preserve the health of the pulp, but there is no single operation that can be said to be a panacea. Indeed we are very far from any form of panacea, although the search will continue. In the case of the child the choice has been much more difficult. Extraction may be a fatal policy for the future dental health of the child. How often we hear when speaking to the orthodontist that the cause of the malocclusion is early loss of deciduous teeth. The preservation of the deciduous teeth is the foundation of a good permanent dentition. The alternative of root-canal therapy leaves much to be desired. In the deciduous teeth it may lead to other difficulties, and in the permanent open-apex tooth is not by any means an easy technique. If the pulp tissue is infected there is no other choice provided that the sepsis can be removed; if not, then the choice is extraction. There is, however, a more enlightened technique for exposures of the deciduous teeth and permanent teeth with an open apex, providing that the pulp is vital and the exposure new. This is the modern technique of partial amputation of the pulp. An article by Russell Cole appears in this issue giving the method of performing this operation. It is a technique with which everyone should be acquainted, and in time it should become a standardized procedure in every dental surgery. Again there is no claim that it is the perfect method; it is not, but in a large proportion of cases it will save a great deal of future difficulty in treatment. The best space maintainer is the natural tooth with a vital pulp, and one of the aims of restorative dentistry is the conservation of a healthy pulp in the tooth. It is all too easy to extract teeth that are apparently too difficult to treat, but the difficulty at that moment is nothing to the difficulty that will arise later on. The orthodontist wishes the first permanent molars had not been allowed to drift mesially while the prosthetist shudders when confronted with the replacement of the upper central incisor by itself when the lateral and other central have moved together and halved the space. This is nothing to the thoughts of the patient, who, deftly applying lipstick, wonders why she has been condemned to an unbecoming smile.

CONTROLLED TOOTH MOVEMENT

MULTI-BAND ROUND ARCH TECHNIQUE

By **C. V. HILL,** B.D.Sc.
Eastman Dental Hospital

ACKNOWLEDGING the limitation in the use of removable appliances in orthodontics, this paper is submitted as an aid to the orthodontically-minded general practitioners in their efforts to cope with an increasing demand for a more definite and controlled tooth movement.

The most successful exponents of removable appliances admit that rotation of teeth and alinement of roots is more efficiently accomplished with a fixed appliance, which should produce a better functional and æsthetic result. Practitioners should not be confused by what may at first appear a little intricate, as more difficult cases, as well as many cases, may be treated by this technique in a relatively short time.

Unfortunately, owing to lack of space, it is impossible to explain methods of diagnosis, prognosis, and treatment planning, and this paper is therefore confined entirely to the consideration of the mechano-therapy of orthodontics. However, it must be appreciated that in fact they cannot be so dissociated.

> "They told him it could not be done,
> With a smile he went right to it,
> He tackled the thing that couldn't be done,
> And—couldn't do it."

In other words, you can't do the impossible. To differentiate between the possible and the impossible it is absolutely essential to have a complete knowledge and understanding of heredity and genetics, growth and development, to recognize the normal with its deviations, and so on to the abnormal. This is the all-important basis of orthodontics, without which an accurate diagnosis and prognosis cannot be made.

Material suggested for Bands and Attachments.—Stainless steel is adequate for this purpose.

Molars: 5 × 0·15 mm. or 0·125 mm.

Bicuspids and cuspids: 3·5 × 0·1 mm.

Cuspids and incisors: 3·5 × 0·1 mm. or 0·08 mm.

Size 0·08 mm. is thinner, and provided a band is well fitted and adapted, it is preferable, taking up less room when all teeth are banded.

Conversion Table

in.	mm.	in.	mm.
0·010 =	0·25	0·018 =	0·45
0·012 =	0·3	0·020 =	0·5
0·014 =	0·35	0·022 =	0·55
0·016 =	0·4		

Spot welding is essential. Solder is disappointing, as it results in breakages in the mouth after a few months. However, judicious use of solder added to the join permits attainment of an excellent tight fit from what otherwise would be a somewhat loose band. In certain instances (where a tooth is being drawn into occlusion from an infra-occluded position) a tight band is essential, as the tendency on ligating this band to the arch wire is to pull the band off the tooth. If precious metal banding material is used, then soldering alone is ideal. Each individual operator invariably adapts and modifies any technique to himself.

Brackets for Attachment to Bands.—The use of a well-formed bracket which will take a rectangular arch wire suggests itself, as this allows mesiodistal movement of roots as well as torque force used to move roots of the labial segment in a palatal direction, as in Class II, Div. 2, retroclination of incisors.

These brackets may be pressed out with a machine (*Fig.* 1, A). The bracket must be rigid, and S.S. tape of 2·5 × 0·25 mm. is recommended. In certain circumstances a narrow tape of 2·0 mm. or even 1·5 mm. may be used. The centre channel takes a snugly fitting arch wire of 0·022 in., whilst the enclosed channels above and below permit ligating wire to be passed through them to tie the arch wire to the centre channel of the bracket

(*Fig.* 1, G, H). The narrower brackets of 2 mm. and 1·5 mm. may be used for lower teeth and canines and bicuspids where the curvature of the labial or buccal surface permits easier adaptation. (The wider the bracket, the more the control over the tooth, within reason.)

In attaching these brackets to the band, care should be exercised in welding all corners as well as the centre channel, otherwise during treatment annoyance is caused when, instead of ligating arch wire snugly into the bracket, the bracket lifts from the band with little resultant tooth movement (*Fig.* 1, G).

The channels normally should be parallel to the band and in the centre. There are desirable exceptions to this. Eyelets may be added to the band mesially and distally to assist in rotation, but this is better done after the band is made and fitted (*see Fig.* 2).

A small length of wire may be welded to the top or bottom of the bracket separate from the band itself, to which a traction rubber may be used for individual tooth traction.

Whilst the vast majority of this technique may be satisfactorily carried out with round arch wire, complete and definite control may only be achieved with a rectangular arch wire. It will therefore at times be desirable to be able to use rectangular wire, if and when necessary. It is therefore suggested that brackets and tubes should take a rectangular wire.

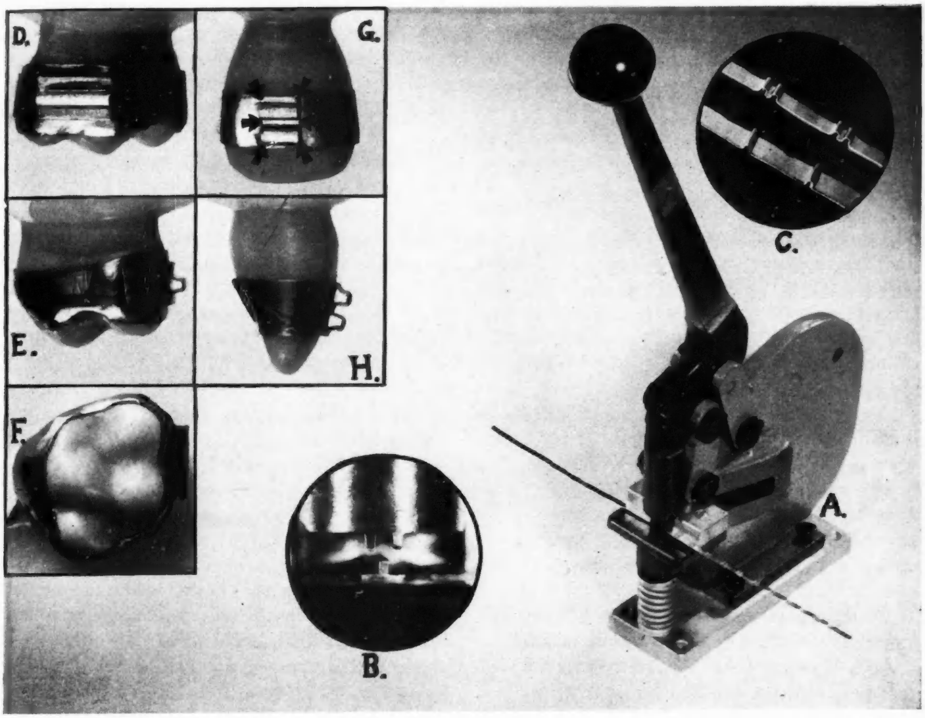

Fig. 1.—A, The press; B, Accurately machined jaws; C, Anterior brackets and molar attachment; D, E, F, Molar attachment; G, Centre channel and welding area; H, Centre channel and ligating channels.

Banding the Teeth.—It is left to the choice of the operator whether he uses band blanks with the brackets already attached, pulling

them up on the teeth themselves, or welds the bracket to the band, after the actual measuring and fitting is complete. Each has its own particular advantages and disadvantages. There are, however, certain essentials. The band, or better still the brackets, should all lie equidistant from the incisal or occlusal edge of all teeth. Here, due allowance should be made if it is intended to have the laterals not quite as long as the centrals and canines. If these bands are not correctly fitted at the commencement, then at some later stage of treatment it will have to be remedied or the teeth will not be at the same level when treatment is completed. The bracket should be at right angles to the long axis of the tooth, about the middle third of the crown, and parallel to the incisal edge.

The same applies to the position of the tube on the molar, i.e., middle third of crown and parallel to the occlusal surface as well as parallel to the buccal surface. It is obvious that this must be carefully carried out or the uprighting of a molar would not be effected, nor would any required rotation be obtained.

The molar tube should be about 3 mm. in length, sometimes even longer. A long tube with a well-fitting arch wire will allow only bodily movement of the tooth, which is in effect difficult to obtain. These rectangular tubes for the molar may also be pressed out on a machine and will take a rectangular wire of 0·025 × 0·021 in. (*Fig.* 1, C, D, E, F).

There are exceptions to the above principles, but these will be explained later.

Arch Wires.—This is an extremely important part of the mechanism and technique. Hard or high tensile stainless steel wire, varying from 0·016 in. (0·4 mm.) to 0·025 in. (0·638 mm.) in sizes 0·016 in., 0·018 in., 0·022 in., and 0·025 in., may be used dependent upon the work required of that particular arch wire.

To consider fundamental properties of a wire: The resiliency or the ability of the wire to return to its original shape, subsequent to the application of any force which has resulted in the deflection of the wire, is essential in the production of tooth alinement. It is obvious that the thinner the wire the less pressure is required to deflect it, which in turn means that less force and more gentle pressure is applied to the tooth tied to the arch wire in the site of the deflection. It requires a heavier pressure to deflect a thicker or stronger wire, and so a heavier pressure is applied to the tooth, which is undesirable. The greatest individual tooth movement is most likely to occur at the commencement of the alinement of the teeth, and for this reason it is essential to use the thinnest arch wire at first, which then results in the gentlest possible pressure being applied to these teeth. Where teeth are well alined and perhaps only retraction is required, then the use of thinner wires is unnecessary, and may be dispensed with in these cases.

Having obtained the maximum amount of tooth movement from the thin wire by tightening at subsequent visits the ligatures which tie the bracket to the arch wire, then a change is made to a slightly thicker arch, and so on until the teeth are almost completely alined. It will be appreciated that the degree of movement for final alinement is small, and is therefore best accomplished with a sturdy or thick arch wire of 0·022 in. round or 0·025 × 0·021 in.

The arch wire should be regarded as a template to which the teeth are slowly drawn, and, with the required changes of arch wires, results in perfect final alinement. For this reason the arch wire should normally be ideal in shape and lie perfectly flat in the one plane. Occasionally it may be necessary to compromise and bend the arch wire to accommodate a tooth or teeth not in the same plane. To facilitate various desired tooth movements, modifications to the arch wire are embodied, such as:—

1. *Traction Loops*, which are bent into the arch to which rubbers are applied in various ways of traction. They are usually employed slightly mesial to the canines, care being exercised so that the traction rubbers will fit over the loops in the desired direction. The loop is bent towards the gingival with the buccal run outside the labial run. Alternatively, other traction hooks may be used by either welding or soldering hooks to the arch wire,

care being taken not to impair the temper of the arch wire (*Figs.* 2, 3).

2. *Stops*, which may be accurately and rapidly bent into the arch wire immediately adjacent to the bracket on any particular tooth according to requirements, e.g., holding

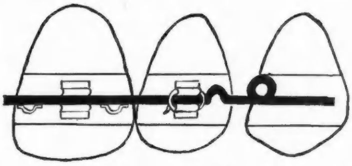

Fig. 2.—Eyelets on mesial and distal of central. Stop bent into arch immediately distal to bracket on |2. Traction loop bent into arch mesial to |3.

a tooth back in anchorage or retaining a required space between any two teeth as well as a tie back-stop for tying the arch back to the distal of the last molar tube (*Figs.* 2, 4). Stops may also be soldered or welded to the arch wire.

3. *Third-power Bends*, which assist tremendously in alinement and rotation of teeth. This requires a detailed explanation. It consists of a type of U-loop bend between two adjacent teeth. A longer length of wire is deflected a greater distance by any given

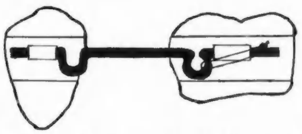

Fig. 4.—Stops bent in arch to hold space between two teeth. Distal stop is an example of tie back stop ligated to distal of arch.

weight than is a shorter piece. Take the case of a lateral tooth lying lingual to its neighbours. The length of wire from A to B is greatly increased by incorporating two third-power bends between |1–2 and |2–3 (*Fig.* 5).

This longer wire may be tied completely into the bracket on the lateral, and exert a much gentler force than a similar diameter wire running straight across from A to B. It also follows that a heavy arch wire will produce less pressure on a particular tooth when using a third-power bend in that position. If only the mesial or distal of the tooth needs moving to gain alinement, then one U-bend only is required, when the result is a

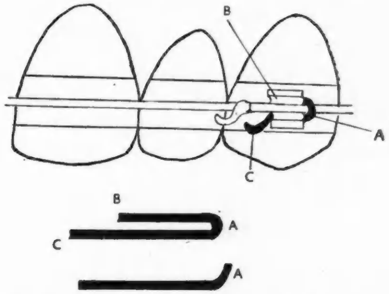

Fig. 3.—Method of construction of individual traction hook. A, Bend to clear arch wire. B and C are passed through tie channels. C is then bent as a hook and also acts as a stop mesial to the bracket. Note traction hook soldered to arch wire.

rotating movement. Greatest control is gained when the two arms of the third-power bend are kept as close together as possible, with the

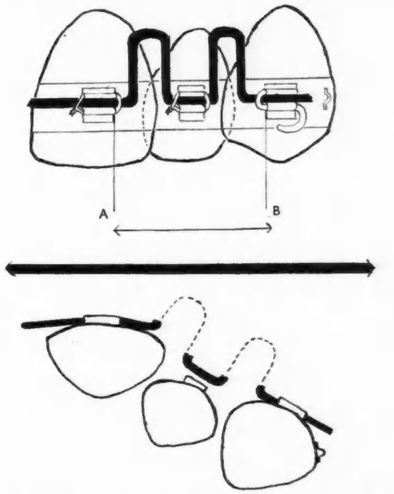

Fig. 5.—Note increased length of wire by using third-power bend from A to B. This extra length results in less force being applied on ligating arch into |2 bracket. Another form of individual traction hook with distal eyelet attached.

brackets on the two teeth involved also in close proximity, but allowing sufficient room to ligate the arch wire. This means that at

times for rotation of a tooth it is desirable to place the bracket either to the distal or mesial of the tooth, particularly when eyelets are not being used.

The length of the third-power bend varies according to the particular requirements. If using a comparatively thick arch of 0·022 in.,

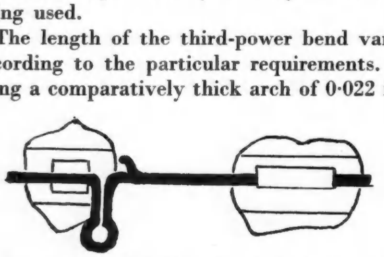

Fig. 6.—Space-closing loop (passive) with tie back stop attached.

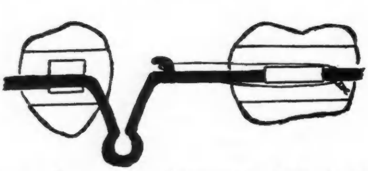

Fig. 7.—Space-closing loop activated by ligating tie stop back around distal end of arch.

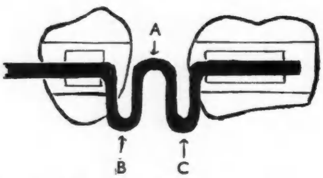

Fig. 8.—Simple space-opening loop requiring compensatory activation at A, B, C, in an attempt to maintain arch in level plane.

then it would require a longer third-power bend if only slight pressure is required than it would if a thinner arch wire was being used. When a long bend is used it may be found to encroach on the alveolar or gingival tissue when ligated to the teeth, and it may be necessary to make a compensatory bend away from the tissue.

4. *Space-closing Loops* may also be incorporated where spaces are to be closed, particularly by forward or mesial movement of the buccal segment. It provides a definite force either by tying the loop back to the distal of the arch in an activated position, or by pulling the end of the arch distally through the tube on the molar until the loop is activated the desired amount, and then turning the arch down immediately distal to the molar tube. In an effort to spring back to the closed position it brings pressure on the distal teeth segment, so moving them forward. However, it must be remembered that this pressure is

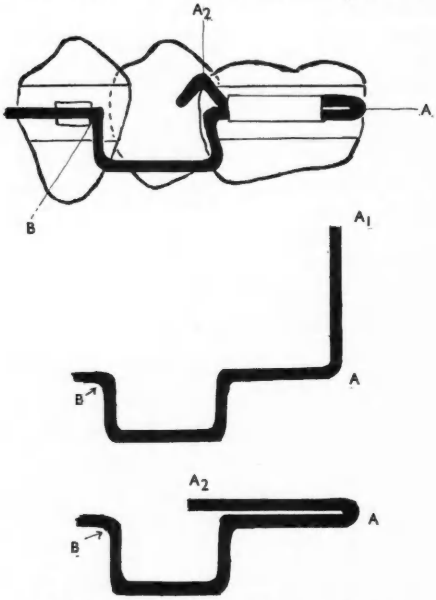

Fig. 9.—Method of construction of space-opening loop (puller-outer). A to A_1 is annealed, then bent into position of A_2. B acts as stop against bracket. Loop is activated by pulling A_2 end mesially through molar tube and bending up. This then acts as stop mesial to tube.

reciprocal, and also tends to move the labial segment distally so that in effect it actually becomes intramaxillary traction.

In the accompanying diagram is a space-closing loop activated by tying a tie stop back to the distal end of the arch. A small indentation may be bent into the distal arm for this purpose, otherwise the tie stop must be spot welded or soldered. The arms should lie together in the passive state and when activated they are separated (*Figs.* 6, 7).

5. *Space-opening* U-*loops* may be used when regaining space between two teeth. Stops are used mesial to the bracket of the distal tooth, and distal to the bracket of the mesial tooth,

so that by grasping a pair of pliers and activating the loops the tendency is to move the two teeth apart (*Fig.* 8).

These loops must be activated in such a way to compensate for the reciprocal bends in the arch wire and so endeavour to maintain the arch in a level plane. Another modified type of arch may be used to gain space between

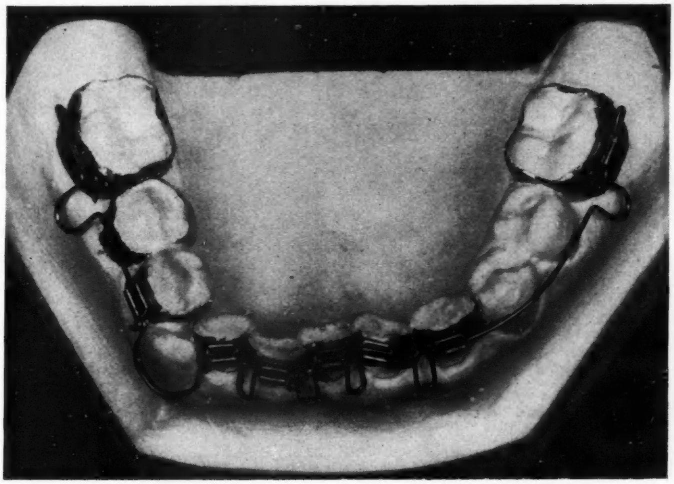

Fig. 10.—Actual case. Third-power bends to aline anteriors. Activation of 'puller-outer' on patient's left side restores arch form in $\overline{|23}$ region. Activation of 'puller-outer' on both sides proclinates entire labial segment, so regaining space for $\overline{3|}$.

a molar and first bicuspid and canine. This requires a double-size tube attachment on the molar which may be pressed with pliers around two pieces of 0·022 in. wire and welded to the molar band. The arch is bent at right angles at A, and from A to A_1, is then annealed, and bent parallel in close contact with the arch lying towards the occlusal of the molar to occupy the position of A_2. With a U-loop or two, one end of which becomes a stop B at the distal of the bracket on the tooth, it becomes evident that using a pair of pliers at the A_2 end, the entire arch wire may be pulled mesially a millimetre or two, when the annealed portion can then be bent up as a stop immediately mesial to the tube attachment on the molar, so activating this arch and moving the molar and bicuspid apart (*Fig.* 9).

At subsequent visits the arch is further activated by again grasping the annealed portion of the wire mesial to the molar tube and pulling forward the desired amount, and again bending up as a stop mesial to the molar band attachment. It now becomes evident that an arch similar to this, but with no stops distal to the bracket on any tooth in the buccal segment, on being activated would result in the proclination of the labial segment, i.e., the four incisor teeth. This arch is free sliding through the brackets on the buccal teeth. The U-loop would be included, as this extra length of wire gives more resiliency and transmits a more gentle force to the incisors (*Figs.* 10, 11).

This type of arch is preferable for opening spaces to the normal space-opening loop, as throughout succeeding activation the arch remains in the one plane, whereas activation of the U-loops themselves is more difficult in this respect.

Coil Springs may be used in conjunction with the arch, either as a push or pull action, and facilitate tooth movement along the arch wire. These coils may be used around the

arch as push or pull coils, or independently of the arch as a pull coil. These coils are wound from 0·15 mm., 0·2 mm., and 0·25 mm. wire in a closed or open state around a wire of arch wire. Pull coils, whether used around the arch or independent of the arch, are activated identically. Having ligated one end back to the bracket, or perhaps the distal end of the

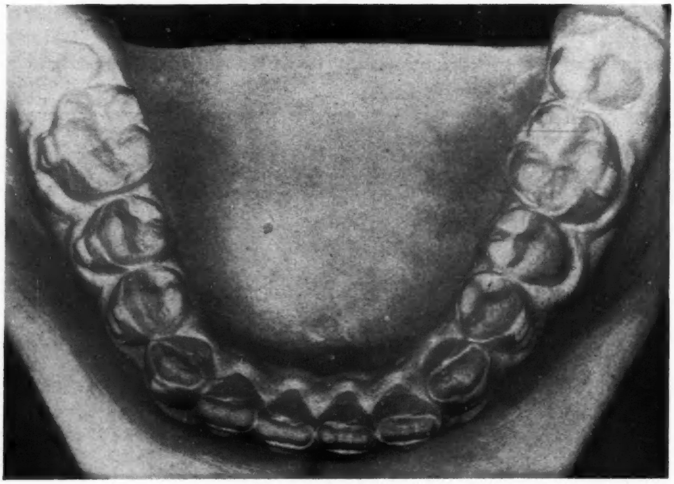

Fig. 11.—Result of previous arch.

slightly greater diameter than the selected arch wire to be used. If the springs are used as push coils, then they are active when in a compressed state between two teeth (*Fig.* 12).

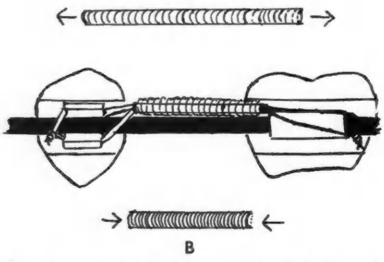

Fig. 12.—A, A passive open-coil spring, which, if compressed between brackets on teeth would create space. B, A passive closed-coil spring. This type of spring is shown ligated as a pull coil independent of arch. May also be used on the arch.

The spring may also be used compressed against a stop on the arch wire at the one end and against a tooth at the other end (*Fig.* 13). With this activation spacing is created between two teeth or a tooth may be moved along the arch, the other end is ligated in the desired activated state to the bracket on the tooth to be moved (*Fig.* 14). In addition, coil springs may be used in conjunction with free-sliding traction hooks. When traction is applied to the hook it compresses the coil, so transmitting

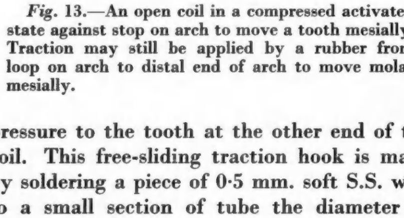

Fig. 13.—An open coil in a compressed activated state against stop on arch to move a tooth mesially. Traction may still be applied by a rubber from loop on arch to distal end of arch to move molar mesially.

pressure to the tooth at the other end of the coil. This free-sliding traction hook is made by soldering a piece of 0·5 mm. soft S.S. wire to a small section of tube the diameter of which is slightly greater than the arch wire being used (*Fig.* 15).

Auxiliary Arches may be used in conjunction with main arch wires.

a. When a tooth is being assisted to erupt into occlusion: Sometimes it is desirable to assist a canine or other tooth down to the occlusal level of the remainder of the teeth in the arch. The main arch wire is used to stabilize the entire arch and is therefore moved (*Fig.* 16). When the tooth is only a couple of millimetres out of occlusion a thicker arch of 0·45 mm. or 0·55 mm. would be necessary to complete the movement. If the tooth is labially or buccally placed it may be necessary to bend the main stabilizing arch out at

Fig. 14.—|3 retracted by a pull coil, mesial end of which is ligated to the bracket on the canine, whilst distal end of coil has been ligated around distal end of arch.

0·022 in., whilst the auxiliary arch, which is only sectional, is of a smaller gauge, the size used being dependent on the distance of the tooth from the occlusion. A 0·35 mm. wire, either straight or curved slightly to the sectional shape of the arch, is passed through the

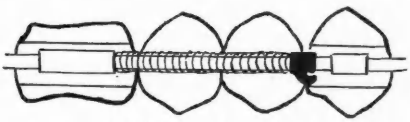

Fig. 15.—Free-sliding tube traction hook. When rubber traction is applied, tube compresses the open coil to move molar distally.

more gingivally situated tie channels of the teeth on either side of the infracluded tooth. This auxiliary arch may be ligated partially (perhaps half way) or completely in the bracket of the tooth to be moved, dependent on how much force is required. This arch tends to return to its original shape, so moving the tooth occlusally. A lighter pressure still is obtained when necessary by not passing the auxiliary arch through the tie channels of the teeth immediately adjacent to the tooth to be right angles or in a curve in the one plane, so allowing freedom for the auxiliary arch to move the tooth down into occlusion without interference from the main arch wire (*Fig.* 17).

b. Rotation of a tooth: A straight piece of S.S. wire is passed through the more conveniently situated tie channel whilst the other end of the wire may be looped over or around the arch, as in *Fig.* 18. This activation tends to whip or rotate the tooth. To activate this auxiliary arch still further, it may be ligated to the main arch nearer the tooth to be rotated. The initial wire used depends on the amount of rotation required and the resultant force transmitted to the tooth when the auxiliary arch is ligated or fixed to the main arch. The auxiliary arch may be slightly curved to lessen the force transmitted to the tooth. Conversely a larger diameter wire up to 0·022 in. may be used finally to complete the rotation, this arch fitting the tie channel more accurately. Care must be exercised to use a stabilizing main arch of 0·022 in., since the reaction of the auxiliary tends to bow out the main arch with the teeth immediately adjacent to the point of ligation. The size of

wire normally used to initiate the correction of a badly rotated tooth would be 0·35 mm., changing to 0·4 mm. or 0·45 mm., and so on up to 0·55 mm.

The eyelet and the third-power bend are optional methods in producing or assisting rotation. They may be used in conjunction with one another when the third-power bend results in a more gentle force when the eyelet is ligated to the arm and so produces a greater distance of movement (*Fig.* 19).

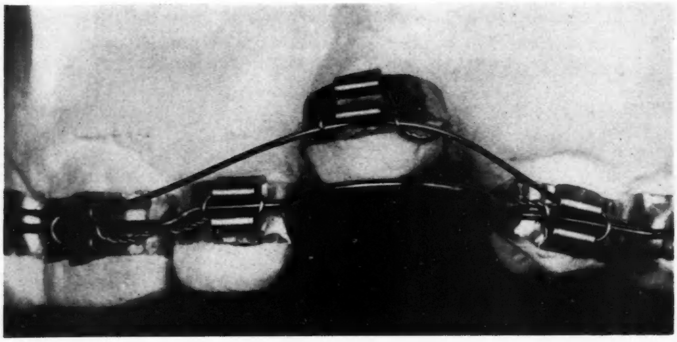

Fig. 16.—$\underline{|3}$ surgically uncovered, but would not erupt. Main stabilizing arch of 0·55 mm. Auxiliary arch of 0·35 mm. passed through gingival tie channels of $\underline{1|14}$ is ligated almost to bracket on $\underline{|3}$. Further activation obtained by ligating above gingival tie channel or by ligating auxiliary arch to main arch in $\underline{|2}$ region. It may be necessary to change to a heavier arch to complete eruption.

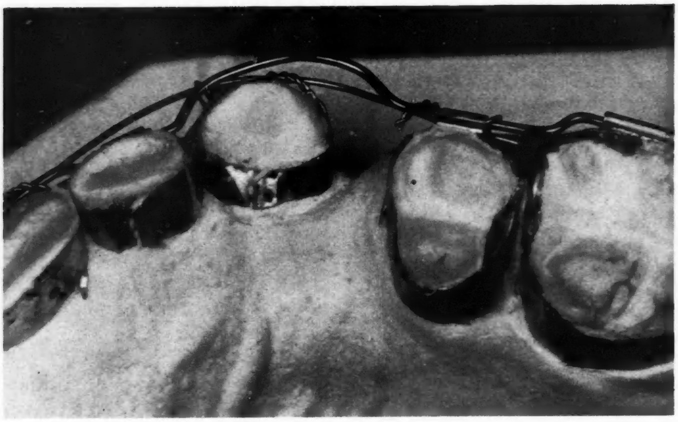

Fig. 17.—Occlusal view of *Fig.* 16. Main arch is curved out in order not to interfere with the eruption of $\underline{|3}$.

c. Uprighting of two teeth after space closure: When an attempt is made to close the space by moving two teeth together, quite often the result is a leaning together of the crowns, whilst the roots of the two teeth are not parallel. After removal of a retainer the tendency is for the space to re-open, the crowns moving slightly apart. It is therefore essential to aline the roots of these two teeth, i.e., the long axes of the teeth should be parallel to ensure a stable result. This method

of uprighting or correcting a lean is comparatively simple. The brackets on the two teeth are offset so that they slope across the buccal or labial surface from the incisal edge towards

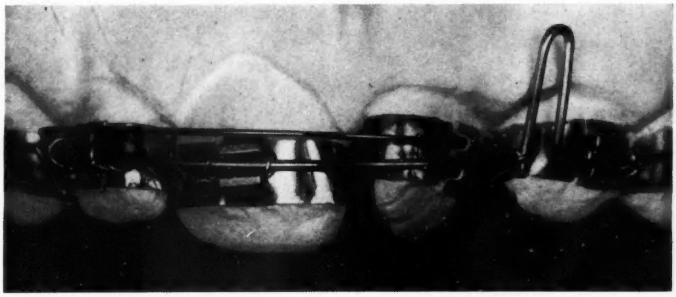

Fig. 18.—Stabilizing arch of 0·55 mm. Auxiliary arch of 0·35 mm., for rotation and apical movement of $\underline{|1}$, is passed through bracket on $\underline{|1}$ and hooked around arch between $\underline{32|}$. Distal eyelet on $\underline{|1}$ is ligated to arm of third-power bend to assist rotation.

the gingival of the space (*Fig.* 20). The degree of offset of the brackets is proportional to the degree of tilt or lean of the two teeth. The size of the wire to be used is also dependent on the degree of offset, i.e., the greater the

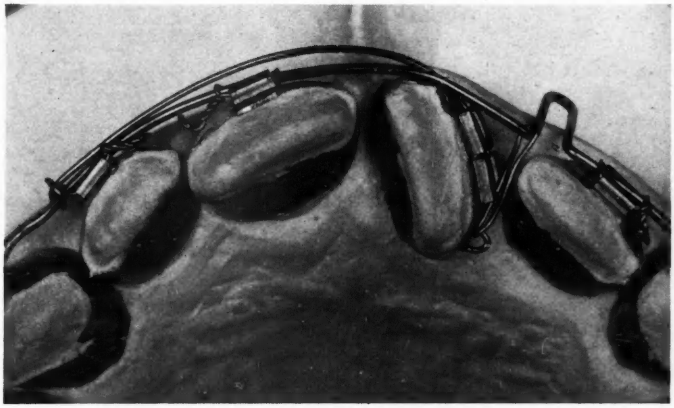

Fig. 19.—Occlusal view of *Fig.* 18. Shows double bracket on $\underline{|1}$ with the distal eyelet ligated to the third-power bend.

offset the finer the wire used to initiate the tooth movement. Here again the wire varies from 0·35 mm. up to 0·55 mm. A straight length of wire is passed through the more gingivally situated tie channels, when it tends to aline the roots of the two teeth (*Fig.* 21).

As this wire becomes inactive, a new length of wire of larger diameter is then used until finally a 0·55 mm. wire may be inserted through the tie channels or the centre channel will allow engagement of the main arch itself. It is essential to ligate the crowns of the teeth together, otherwise, instead of the roots alining, the crowns tend to separate and the space re-opens (*Fig.* 21).

This resultant leaning of the teeth may be largely prevented if, when initially banding the teeth, the brackets are slightly offset on

the two adjacent teeth on either side of the space.

An Individual Traction Loop may be made and used at any time to give traction to an

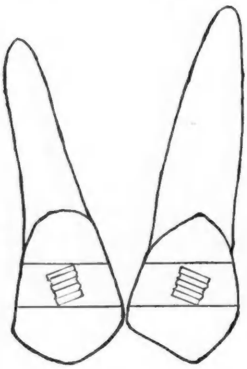

Fig. 20.—Diagrammatic representation of crowns of two teeth in contact after space closure, but roots not parallel. Position of brackets offset to effect paralleling of roots.

individual tooth. A 0·4 mm. wire is bent back parallel on itself, the arms being the same width apart as the distance between the two tie channels of the bracket. The looped end A is bent at from 60° to 90° to allow engagement of the arch wire. The end B is cut short so that it lies enclosed in the tie channel when the loop is inserted. Now B and C are passed through the tie channels, the arch wire being engaged by A. Then C is bent around to form a traction hook, part of the bend acting as a stop against the bracket. When inserted from the distal of the bracket, A tends to prevent rotation (*see Fig.* 3).

Traction and Anchorage.—Before discussing any tooth movements it is essential that mention is made of traction and anchorage. They are considered at the same time as they are inseparable at all times. To every action there is an equal and opposite reaction. This, whilst elementary, is all-important in the application of traction to selected anchorage in the production of desired tooth movement. As the force from any rubber or spring or space-closing loop is reciprocal, then anchorage must be carefully selected in such a way that the desired tooth movement is effected, but not at the expense of the movement of the anchorage teeth unless this movement is required also. To check on the resultant movements after applying traction, it is imperative to have up-to-date and accurate models with entirely correct bite relationship marked on the upper and lower buccal segments.

The most careful attention must be paid at each visit of the patient to ensure that only the intended desired movements of teeth are occurring. This is only possible with constant checking against the models taken immediately prior to initiation of active treatment.

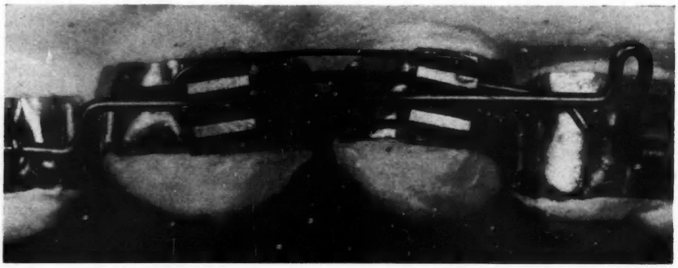

Fig. 21.—An auxiliary arch of 0·45 mm. passed through gingival tie channels to upright two teeth after space closure. Note crowns ligated together.

Traction may be categorized into:—

1. *Intramaxillary* traction along any one jaw, upper or lower, by rubbers, pull coils, or space-closing loops.

2. *Intermaxillary* traction from the upper to the lower jaw by rubbers in either Class II or Class III traction.

3. *Extra-oral* traction where the opposite reactive force is taken by the head when using a head gear or the neck when using a cervical.

These various forms of traction are selected after careful consideration in each individual tooth not to move because of too light a pressure.

The case having been diagnosed, careful consideration is then given to the actual treatment plan which should be thought of in terms

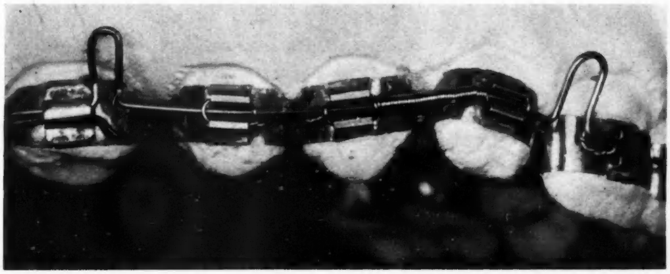

Fig. 22.—Actual case. $\underline{3|}$ unerupted. Includes a number of modifications on one arch. Offset bracket on $\underline{2|}$ for root alinement. Third-power bend with mesial eyelet for rotation. 'Puller-outer' space-opening arch for distal movement of molar and proclination of labial segment. Active compressed-coil spring to move $\underline{54|}$ distally, $\underline{2|}$ mesially, to close spaces, automatically opening space for unerupted $\underline{3|}$ between $\underline{4|}$ and $\underline{2|}$.

case, dependent upon what anchorage is available and what desired tooth movements are necessary. All three types of traction may be used simultaneously in the one case. An extremely common mistake is the use of too heavy a traction, which results in a physiological pressure being distributed to the anchorage teeth which move, whilst the tooth or teeth originally intended for movement remain stationary. This is illustrated with incorrect activation of canine retractors on a removable plate when the buccal segments and incisors move forward, the canine remaining in its original position. It is unusual for a of required individual tooth movement and the best manner in which these desired movements may be obtained. This involves modifications such as the offsetting of brackets to prevent the leaning of teeth, mesially or distally placed brackets to aid in tooth rotation, the inclusion of eyelets, welded wire to bracket for individual traction, so that when the arch wire (incorporated in which are any required stops, loops, third-power bends, coil springs), is inserted, the greatest amount of tooth movement may be obtained with as few changes of arches as possible (*Fig.* 22).

(*To be continued in a subsequent issue.*)

INSTITUTE OF BRITISH SURGICAL TECHNICIANS (INC.)

Dental Section

The following lectures will be given during October:—

LONDON

"Partial Denture Design and its Relation to Mouth Damage" by Mr. K. P. Liddelow, F.D.S., H.D.D. at the Eastman Dental Hospital, Gray's Inn Road, W.C., on Tuesday, Oct. 26, 1954, at 6.30 p.m. Tickets are obtainable on sending stamped addressed envelope to the Institute of British Surgical Technicians, 6, Holborn Viaduct, London, E.C.1., or through members of the Institute.

MANCHESTER

"Intra-oral Prosthesis in the correction of Facial Deformities" by Mr. H. D. Penney, F.D.S. R.C.S. (Eng.), of the Regional Maxillo-Facial Unit, Wythenshawe, Manchester, on Thursday, Oct. 14, 1954, at 7.30 p.m., at the Turner Dental School, Bridgeford Street, Manchester, 15. Tickets are obtainable on application, with stamped addressed envelope, to Mr. A. Litherland, L.I.B.S.T., 32, Whitebrook Road, Fallowfield, Manchester, 14.

MEDICAL ASSESSMENT AND THE DENTIST

By **R. W. M. STRAIN,** B.Sc., M.D., F.R.C.P.I.

Lecturer in Medicine to Dental Students in the Queen's University of Belfast

MEDICINE, the science and art of restoring and maintaining health, is a very wide subject. It is unfortunate that the very word as applied to the profession as distinct from the stuff that goes into bottles should have two degrees of meaning in British life at present. In its restricted sense it is used to cover the art of the physician as distinct from that of the surgeon and certain other specialists, and to overcome this difficulty the term "internal medicine" is used with this special meaning in America and on the Continent. Even this is not a very satisfactory expression as it almost implies the existence of external medicine which might be anything from dermatology to ointments and rubs. The treatment of disease by the physician using physical and pharmacological methods is, accordingly, only a part, though an important part, of the art of healing. Medicine in its broader meaning must include all methods and branches of healing. Health, like peace, is indivisible, and all those who promote health must be regarded as pursuing a common aim. Family doctors and dentists, physicians and surgeons, psychiatrists, nurses, and the various medical and dental auxiliaries who have expert or technical knowledge and skill all contribute to the health of the individual and its maintenance. Inevitably it follows that in spite of both the Law of the Land and the dictates of Regional Anatomy, there will be overlap in these subdivisions of the one great Art. Inevitably some of these people will be faced with problems outside their professional depth not only in treatment but in diagnosis. The family doctor or the physician may discover the presence of a tumour which the surgeon successfully removes and on which the pathologist finally puts a name.

In this wider concept of medicine, the dentist must regard himself not merely as the custodian of the teeth as anatomical structures. The teeth are there to fulfil a physiological function, the supply of properly masticated food to the lower parts of the alimentary tract, and it is this function rather than the teeth themselves that is fundamental. The dentist is thus concerned essentially with nutrition, and he has often a full contribution to make to the general well-being of the patient in this way. In a less important though still highly significant manner he contributes to health by the removal of foci of sepsis which, if seldom primary causes of remote or general disease, are predisposing causes to these. The relief of pain of dental origin may be a purely local matter, but skilful dentistry may in some cases be a factor in the relief of symptoms such as headache or insomnia the cause of which had not been evident.

No day can pass in the life of the practising dentist in which he is not faced with some problems of general medical assessment. His ability to deal with these is limited by two things: what he was taught about medicine in his student days; and, armed with this preliminary understanding, what he has learnt from his own professional experience.

Nowadays the dental student, segregated from his medical colleagues, spends a year in the academic and bedside study of general as distinct from dental medicine. He learns to take a case-history as fully as the doctor, and he learns to use his eyes and his hands to examine the patient. He learns palpation and percussion, and he may or may not use a stethoscope. At the end of that time he can have acquired a remarkable understanding of medicine, though not the working knowledge of it that the medical student will have at the end of three further years of intensive work. He may know a dangerous amount about heart-sounds or nothing at all, but he knows that the evidence of cardiac insufficiency is based on symptoms and the state of the veins and the other organs rather than on murmurs. He may, indeed, be able to diagnose precisely

the thrill of mitral stenosis or the pulse of free aortic regurgitation, but, far more important, he will know whether the heart is producing symptoms. He will have an understanding in general terms of why the patient may arrive in his surgery breathless. He can recognize the chronic bronchitic subject even when the lungs are in a quiescent phase, because of changes such as the barrel-shaped chest and the prolonged expiration. When he sees that the tips of the fingers clutching the arms of his dental chair are bulbous, he will have some idea of the various reasons why this is so. He will know from his own experience how important is a reliable case-history and how often it is likely to be borne out by what is found when the patient is examined. Nature indeed parts with her secrets grudgingly, and the signs of disease are no exception. The dental student will have discovered for himself how difficult are the methods of clinical examination, the detection of physical signs corresponding to physical states, and how much care is needed to interpret these in terms of disease processes. He will realize how often the doctor must of necessity come to a working conclusion on evidence that is far from complete.

Every dentist knows perfectly well for himself how much of this clinical discipline, the actual systematic physical examination of the patient, he carries with him into his dental work. There are the few who will take up special branches of dentistry or dental research and who will continue with medico-dental correlations of various kinds. For this fortunate number the knowledge of dentistry and the knowledge of medicine grow side by side. For the great majority of dentists the clinical study of medicine is limited, though each will continue to learn, though more slowly, in his daily dental practice. For him the understanding of the subject in its widest sense must remain the sheet anchor, for he has himself become essentially a specialist in one of the branches of restoring and maintaining health.

Certain problems of medical assessment are always before him. Some of these are much more important and common than others, and it is only possible to consider certain of them briefly in this article. It will afford him some consolation to remember that often no one person is capable of making a full assessment in every case. When special problems arise, the answer is found sometimes only after most elaborate team work. The dentist will only be required to go part of this tedious way, and he will have done his duty in this respect if, not being satisfied himself, he takes steps to ensure that a final answer is obtained.

The following are matters in which medical assessment is of special importance.

I. DENTAL CONDITIONS WHICH ARE CAUSES OF OR FACTORS IN THE PERSISTENCE OF DISEASE, INCLUDING MALNUTRITION

Such conditions present one of the widest problems in dentistry, and the experienced dentist has a very big contribution to make to the welfare of this group of patients. Often medical assessment has already been made, and the cases are referred by the doctor to the dentist for his opinion. In the past many sets of teeth have been sacrificed on the high altar of focal sepsis without material gain, while the ability of the patient to masticate his food has been reduced. It is true that a distant arthritis may have flared up for the time being after extraction of septic teeth, but the final result has far too often not justified the extractions. What the doctor does appreciate is that the dentist comes to know from professional experience how much general health can be improved by dental care. Pathogenic organisms find in the unhealthy mouth a good starting-point for a direct journey to other parts of the alimentary or respiratory tracts. The unhealthy mouth is not conducive to good appetite, nor inadequate dentition to thorough mastication. Probably the patient most often referred by the doctor for special dental opinion and help is the dyspeptic subject, where the mechanical irritation of the gastro-intestinal mucosa by ill-masticated food is a factor in the delayed healing of peptic ulceration. One special point is of note. Sepsis of any kind, including oral sepsis, makes the

standardization of the diabetic subject difficult and uncertain, and these cases are well worth the most scrupulous attention.

II. ORAL EVIDENCE OF GENERAL OR LOCAL DISEASE

It is obviously not possible to cover here all the conditions which may come to light in this way, but there may be occasions when the dentist is the first person to have the chance to recognize some early change. There are purely local conditions such as malignancy, and any suspicion that there are early neoplastic changes should point to the need for surgical opinion, with the advice that no prosthesis should be worn till this opinion has been obtained and the diagnosis settled one way or the other. The presence of a post-nasal drip, especially one which is seen on successive occasions, is likely to be due to a chronic sinusitis which may have escaped recognition.

There are very many evidences of general disease to be found in the mouth. They may be clearly recognizable for what they are, but if the appearances are abnormal, and cannot be interpreted by the dentist, then he should follow the matter to its logical conclusion and refer the patient to his doctor.

Syphilis may show itself in the mucous membrane or the palate. The congenital syphilitic malformations of the teeth are well known. The health of the gums may reflect a vitamin deficiency. The heavy metals may show their presence by the deposit of a sulphide near the gum margin, and especially is this the case in lead poisoning. Addison's disease, adrenal insufficiency sometimes of tuberculous origin, is often accompanied by the formation of areas of melanin pigmentation in the mouth or on the lips. Acute tonsillar conditions are seldom without local symptoms and the patient comes under medical care on account of a sore throat, but sometimes leukæmia or even malignancy may be the cause of marked unilateral tonsillar hypertrophy not causing discomfort. Nor should the dentist forget to use his sense of smell, for the recognition of acetone in the breath may lead to a diagnosis of diabetes.

III. GENERAL ANÆSTHESIA IN DENTISTRY

The dentist, like the doctor, is legally entitled to give a general anæsthetic. Neither should do so without some knowledge of the medical fitness of the patient. Cardiac and respiratory disease are the disabilities usually giving rise to difficulty, and perhaps forming a complete barrier to anæsthesia for any measure other than a life-saving operation. Acute cardiac or respiratory diseases are not likely to raise any question, as they are both probably under immediate medical care. Should the question of anæsthesia for dental treatment arise, a decision will be reached in consultation with the anæsthetist and those already in charge of the case.

In the recognition of chronic cardiac or respiratory disease, the history is of great importance. There is no significant loss of cardiac reserve if the patient can take strenuous exercise without breathlessness or pain. The reverse does not necessarily follow. The obese person, out of any sort of training, may be breathless on stairs without suffering from heart disease. The person with an impaired coronary circulation has usually a history of pain on reaching a certain degree of effort. The pain is substernal or in the throat or neck, and may radiate down the arm, especially the left arm. It comes on while the effort is being made, causing the victim to desist, and stops when the patient has rested. The degree of pain is subject to wide variation from case to case, and may be anything from discomfort to a crushing or gripping sensation.

In chronic respiratory disease there is also a history of breathlessness on effort and of cough with the production of sputum. There are usually, too, frequent episodes of acute respiratory disease such as bronchitis, asthmatic attacks, or pneumonia.

The state in which the chronic cardiac or respiratory patient is seen on arrival by the receptionist may be diagnostic, especially if this has involved a walk up hill or the negotiation of stairs. This is an opportunity that may not have been afforded to the dentist himself. A word with the patient's doctor on the telephone may clarify the position.

The patient with active respiratory disease, acute or chronic, for example the bronchitic who is wheezing, is a bad anæsthetic risk. Aspiration of infected material farther down the bronchial tree is likely, especially if the patient is anæsthetized in the dental chair where his bronchial drainage is at a great disadvantage during unconsciousness. The chronic cardiac case is often not such a bad risk as might be thought. The skill of the anæsthetist is all-important, especially his ability to give an anæsthetic for dental work. None the less, such a patient should not have a general anæsthetic without an exact knowledge of the degree and type of incapacity present. If the matter is in doubt, the only wise course is to consult the patient's doctor and let him make an assessment. If he, too, is in doubt, he will get still further advice.

IV. SUBACUTE BACTERIAL ENDOCARDITIS

The possibility of infective endocarditis must be one of the nightmares of dental practice. At times of dental extraction organisms from the site often invade the blood-stream, but do not result in septicæmia. Occasionally, however, the endocardium is invaded, and the result is subacute bacterial endocarditis with its three-fold syndrome of septicæmia, embolic phenomena, and carditis. The hearts at risk in this respect are those already damaged by rheumatism or congenitally deformed. The usual organism responsible is the *Streptococcus viridans*, which, like the poor, is always with us, and is always waiting to fall, like a sword of Damocles, on the "prepared soil" of a susceptible endocardium.

It is now well recognized that this risk is minimized when extraction is carried out under a penicillin "umbrella". This itself is not without disadvantages. Severe penicillin reactions of an allergic type are not rare, while the exposure of organisms to the antibiotics for only short periods is resulting in the production of penicillin-resistant strains which are becoming yearly more common.

When should the "umbrella" be used? From the dental point of view, whenever the condition of the mouth shows a likelihood of the introduction of organisms into the blood-stream at the time of extraction, and from the medical, when there is evidence that the heart is already damaged. The medical assessment is difficult. The dentist can hardly be expected to recognize heart disease unless it is of sufficient degree to produce symptoms of which the outstanding one is breathlessness on effort. That, unfortunately, is not enough. It is possible for heart disease, congenital or acquired, to be present, but not to be of sufficient seriousness to bring itself to the notice of the patient or his parents in this way. A history of rheumatic fever, chorea, recurrent tonsillitis, or growing pains may suggest the possibility of rheumatic carditis, but cases of undoubted rheumatic heart disease are met with frequently where there is no history whatever of any of these things. Where there is cardiac malformation other congenital deformities may be present, and cyanosis and finger clubbing may be observed, but in such cases it is extremely likely that a diagnosis of congenital heart disease has already been made. Minor congenital cardiac abnormalities are ordinarily accompanied by no symptoms and no signs except in the heart itself.

If the dentist feels that he is likely to stir up infection in the gums, his wisest course is to consult the family doctor. Only medical examination is likely to discover the defective hearts, and even with the greatest care it is not possible to pick out all the hearts which are infection-prone. Why antibiotics should not always be used has already been explained.

V. ABNORMAL HÆMORRHAGE

The dentist will often ask himself whether there is any abnormal risk of bleeding. Pathological hæmorrhage presents so many difficulties in treatment that it is well to bear the possibility in mind, and to try to recognize the condition in advance. The patient may volunteer the information that he or she bleeds abnormally. There may be a history of bruising readily without actual external blood-loss. This may follow frank injury, or there may be no history of trauma though

the patient assumes that there must have been some blow or crush unrecognized at the time. These subcutaneous hæmorrhages may be gross, as in the common black eye, or they may have the form of irregular hæmorrhagic spots forming the rash called purpura. The condition may indeed have been the result of trauma, and be the response of physiological blood and tissues, but, on the other hand, it may be a manifestation of one of several diseases. It may, for example, be evidence of primary or thrombocytopenic purpura where the platelets and their cousins, the cells of the capillary endothelium, are at fault. Bleeding is spontaneous in this type, and the coagulation time is normal, though the bleeding time is prolonged. The same sort of rash can occur as part of scurvy. Here there are also likely to be subperiosteal hæmorrhages resulting, for instance, in pain in the legs, though the condition that will attract the dentist is the sponginess of the mucoperiostium of the gums and the resultant bleeding. Scurvy is not likely to be found in any person for whom the potato is part of the standard diet, though people living a solitary life may so neglect their health as to become scorbutic through lack of citrous fruits and potato, though in no financial stress.

Hæmophilia shows itself by hæmorrhage following slight injury such as razor cuts, injuries to joints, and the bumps that would pass unnoticed in the ordinary person. Clotting is at fault, but the reason is unknown. The patient is a male, and there is characteristically a family history of inheritance through the mother. The tendency to bleed is inconstant, and the risk varies from time to time.

The patient with obstructive jaundice is prone to undue bleeding during surgical procedures on account of hypoprothrombinæmia.

The diagnosis of the hæmorrhagic state and its exact cause may be clear. The proof is often a matter not only for the dentist and the family doctor, but for the clinical pathologist, whose assistance in treatment is often necessary too. If the tendency to bleed is recognized, a small transfusion beforehand will do much to secure normal hæmostasis in all types. Prophylactically ascorbic acid will correct the bleeding tendency in scurvy. While the jaundiced patient is seldom the subject of dental surgery, though often of laparotomy, intramuscular vitamin K may stabilize the blood-clotting mechanism.

It is clear that when dental surgery is really necessary in any of these cases, it will be carried out within reach of laboratory and blood transfusion services.

CONCLUSION

The practice of dentistry raises frequent questions of general medical assessment. If certain of the major issues are remembered the need for special assessment will not be overlooked, and as the dentist is in this respect only a court of first instance, he will find in the family doctor a colleague with whom he can, when necessary, form a joint opinion. It is, indeed, only in this way that the community will derive the maximum benefit from the health services.

NEWTON HEATH TECHNICAL COLLEGE

Applied Science Department

The following students of the Dental Technicians' Course have been awarded prizes from the funds supplied by the local branches of the British Dental Association, the Dental Technicians' Section, U.S.D.A.W., and the Manchester Dental Committee:—

Final: H. Baxter, who also receives a specially awarded prize for exceptional attendance during the five years' evening school course.

Intermediate: First Prize, A. Nottingham; Second Prize, G. Dyson.

Under the new regulations of the City and Guilds of London Institute, adult technicians wishing to sit for the Final Examination of the Dental Technicians' Course must have first obtained an Intermediate Certificate.

Shortened versions of the course to Intermediate and Final Stages suitable for technicians over 25 years of age will be available during the 1954–5 session commencing in September.

PARTIAL AMPUTATION OF THE PULP

By G. F. RUSSELL COLE, D.D.S., B.D.Sc.
Demonstrator, Department of Restorative Dentistry (Children's Section), London Hospital Dental School

THERE have been many occasions in the past where, owing to pulp involvement, children have lost teeth which might have been saved by partial amputation of the pulp. This is the removal of the coronal portion of a vital pulp performed in such a manner as to leave the pulp tissue remaining in the root canals in a healthy vital condition. This operation can therefore only be used for teeth with a reasonably healthy pulp with a good blood-supply. It is used most commonly in children in cases of fractured incisors with apices that are not fully developed, and in deciduous molars where the pulp is exposed during cavity preparation, and it is frequently the only method of retaining these teeth in a vital condition.

Fig. 1.—Suitable armamentarium for partial amputation of the pulp.

Ellis (1952) summarizes the indications for partial amputation of the pulp in a fractured incisor as:—

1. Extensive exposure of the pulp, even including the whole bulbous coronal portion, projecting beyond the end of the hard tooth structure in a pedunculated form.

2. Hæmorrhage has probably taken place.

3. The pulp may have been exposed for 48–72 hours.

4. The root end of the tooth is still in the process of development; all instances of even minute exposure, which might otherwise be suitable for capping, are better treated by partial amputation if the apex is wide open.

5. There should be no complications such as root fracture or displacement.

6. There should be evidence of vitality reaction or red blood in the exposed pulp; a degenerating or necrotic pulp will give neither of these signs.

The technique is simple, but must be performed under aseptic conditions. A rubber dam must always be used, and an aseptic technique that is normally acceptable for root-canal therapy must be employed. A suitable armamentarium is illustrated in

Fig. 1, where a molten-metal sterilizer is shown as an essential adjunct.

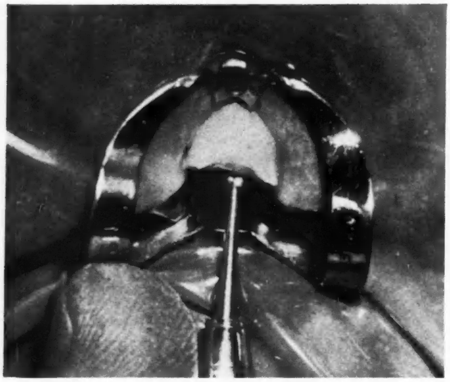

Fig. 2.—Opening into the pulp chamber with a sterile bur.

Fractured Incisors.—For fractured incisors the procedure is as follows:—

1. Anæsthetize with local infiltration. (The author uses xylocaine 2 per cent.)

4. With a sharp-sided instrument, such as a discoid, or a sharp excavator, which can be introduced down the side of the pulp chamber, amputate the pulp cleanly at the constriction

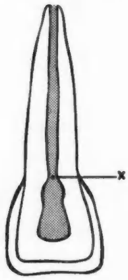

Fig. 3.—Diagram showing constriction just above cemento-enamel junction, which is the ideal site for amputation (X).

which is present just beyond the level of the cemento-enamel junction (*Fig.* 3).

5. Remove the debris from the pulp chamber, and irrigate with sterile distilled water or a normal saline solution, introduced by means of a hypodermic syringe (*Fig.* 4). The

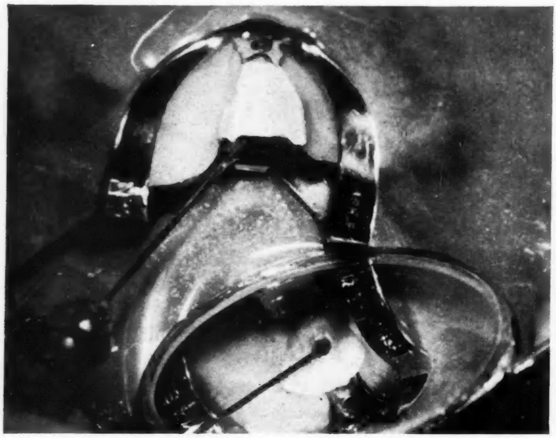

Fig. 4.—Method of irrigating pulp chamber after amputation.

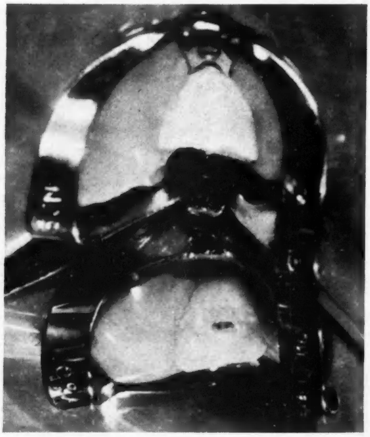

Fig. 5.—The pulp after amputation.

2. Apply rubber dam, and sterilize the field of operation with dettol or iodine.

3. Open into the pulp chamber with a sterile bur (*Fig.* 2), removing the whole of the roof of the pulp chamber, but traumatizing the pulp tissue as little as possible.

pulp tissue can be seen clearly in the root canal (*Fig.* 5) and this should appear a healthy red colour.

6. Dry the pulp chamber, control bleeding with sterile cotton pellets, and cover the pulp tissue with sterile calcium hydroxide,

mixed to a thick creamy paste with sterile distilled water on a sterile glass slab with a

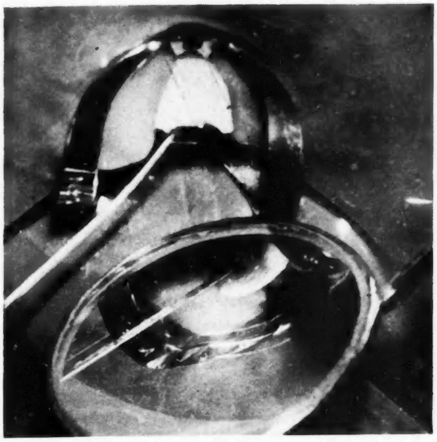

Fig. 6.—Covering the pulp tissue with calcium hydroxide paste.

sterile spatula (*Fig.* 6). This should be inserted without pressure.

7. Cover this with a thin layer of paraffin wax, introduced on a warmed root-canal plugger.

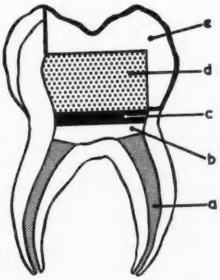

Fig. 8.—Diagrammatic representation of partial amputation in a deciduous molar. a, Vital pulp tissue; b, Calcium hydroxide; c, Paraffin wax; d, Cement; e, Amalgam.

8. Fill the pulp chamber with zinc oxyphosphate cement. *Fig.* 7 shows diagrammatically the completed treatment.

The tooth should be checked for continued vitality at regular intervals, and for continuation of apical development by regular radiographic examination.

In some cases it has been found that death of the pulp and subsequent necrosis has taken place after the completion of apical development. For this reason it is sometimes advocated that complete pulp extirpation and root

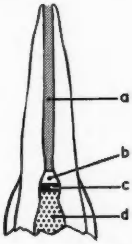

Fig. 7.—Diagram of partial amputation of pulp in an incisor. a, Vital pulp tissue; b, Calcium hydroxide; c, Paraffin wax; d, Cement.

filling should be performed as soon as the apex has fully developed.

Deciduous Molar.—The procedure for a deciduous molar is very similar, and is shown diagrammatically in *Fig.* 8. Again, a rubber dam is essential, and can be applied very simply by isolating one tooth only by means

Fig. 9.—Isolation of a lower deciduous molar by rubber dam.

of a clamp, as shown in *Fig.* 9. A sharp excavator passed along the floor of the pulp chamber, after complete removal of the roof, is the most satisfactory method of amputating the pulp. If amalgam is to be used for the

final restoration of the tooth this should be inserted at the same visit, as dressings tend to become dislodged easily from deciduous molars. For this reason also the amputation should be performed immediately the pulp is found to be exposed, rather than leaving it with a dressing until a subsequent visit. These

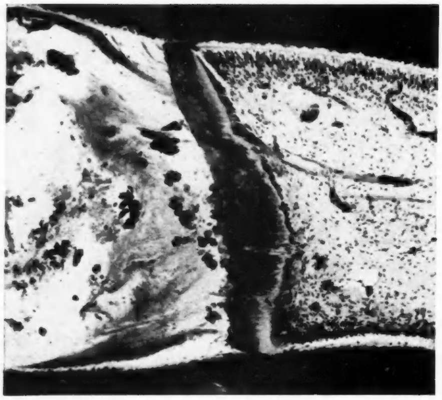

Fig. 10.—Photomicrograph of tooth section one month after partial amputation of the pulp. The calcific barrier can be seen developing between normal pulp tissue (right) and the calcium hydroxide layer (left). (× 50.)

teeth should also be checked at regular intervals for continued pulp vitality, and radiographically to see that normal root resorption is taking place. Bite-wing radiographs give a clearer picture of the roots of deciduous molars than the ordinary intra-oral film.

A histological section of a partial amputation is shown in *Fig.* 10. This was performed in a bicuspid that was to be extracted for orthodontic purposes, and shows the condition of the pulp one month after amputation. The calcific barrier can be seen clearly, and this has been produced by the action of the calcium hydroxide on the pulpal tissues.

This barrier can be seen developing radiographically in cases where amputation is performed in incisors, and *Fig.* 11 shows a case followed through, the radiographs also showing continued apical development.

My thanks are due to Mr. A. M. Horsnell, Director of Conservative Dentistry in the London Hospital Dental School, for permission to use these illustrations, and to Mr. P. Broadbery and Mr. J. Morgan of the Photographic Department of the London Hospital

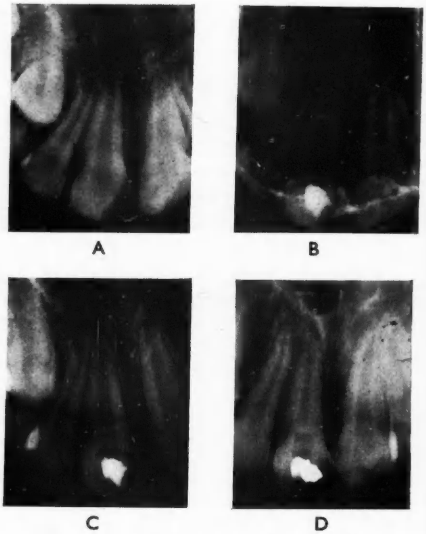

Fig. 11.—A, Partial amputation of a fractured incisor performed in May, 1953; B, One month later: The calcific barrier can be seen developing; C, Two months later; showing thickening of the calcific barrier and continued apical development; D, Fourteen months later (July, 1954), showing completed apical development.

for preparing the photographs. I also wish to thank Miss P. Archer, Medical Artist to the London Hospital Medical College, for preparing the drawings.

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A SYMPOSIUM ON CLEFT PALATE—*continued.*

II. THE DEVELOPMENT OF THE ORTHODONTIC PROBLEM*

By M. A. KETTLE, F.D.S. R.C.S.

BEFORE the successful orthodontic treatment of cleft palate can be undertaken it is necessary to have an understanding of the problems peculiar to these cases and of the factors which contribute to their dental deformity. The orthodontic problem is created by the combination of a varying number of adverse influences which act on the growth and development of the upper arch. Cases of complete unilateral cleft lip and palate will mainly be considered, although the other groups will be discussed to illustrate a particular point.

THE NATURAL TENDENCIES OF THE ARCHES WITHOUT LIP OPERATION

A child born with complete unilateral cleft of the lip and palate does not possess a state of balance between the hard and soft structures of the mouth. Normally the arch development is influenced by the counteraction of the stimulating forces exerted by the tongue and the restraining action of the lips. In complete unilateral cleft lip and palate the restraining and moulding influence of the upper lip is lost to a great extent so that the tongue is capable of exerting an unrestrained forward thrust upon the anterior part of the upper arch. In addition to this the tongue bulges upwards into the space of the cleft palate, with the result that the width of the cleft is increased.

This increase in the width of the cleft due to the lateral displacement of its segments, whilst occurring on both sides in unilateral cleft takes place mainly on the affected side so that the smaller segment is rotated laterally. The other side is not affected to the same degree because of its attachment to the nasal septum.

Delay in the lip operation usually allows this displacement to proceed. *Fig.* 1 shows the model of a child whose operation was

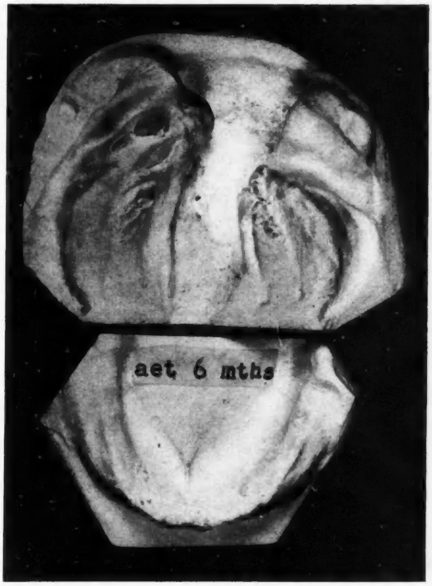


Fig. 1.—Models of child, aged 6 months, with complete unilateral cleft lip and palate. Immediately before lip operation.

delayed until the age of 6 months. The anterior part of the arch which belongs to the larger segment also projects forwards. This displacement may be due to:—

a. A lack of restraining lip action.

b. The forward thrust from the tongue.

c. The forward growth of one side of the dental arch unapposed by the restraint of the other jaw segment.

* Being a further contribution to a symposium at the meeting of the British Society for the Study of Orthodontics held on February 8, 1954.

d. Unrestricted forward growth of the nasal septum which is attached to the large segment side.

THE FACTORS WHICH MAY CONTRIBUTE TO THE DENTAL DEFORMITY

The factors which exert a particular influence upon the growth of the jaw at a given time and may also culminate eventually into a typical cleft lip and palate deformity will

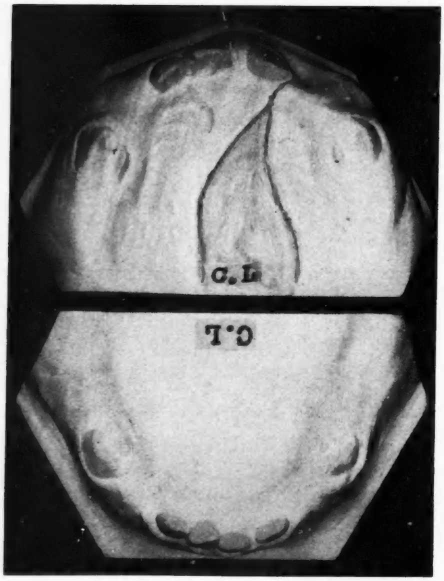


Fig. 2.—Models of child, aged 18 months, immediately before palate operation. Shows medial displacement of upper arch segments following lip operation.

be considered. These factors may be summed up:—

a. The medial deflection of the maxillary segments after the primary lip operation.

b. A lag in the downward and forward influence exerted by the nasal septum.

c. A defect in the forward thrust of the upper arch due to the surgical interference of the pterygo-palatine and the transverse palatine sutures in the first instance and later due possibly to the presence of avascular scar tissue in relation to these sutures.

d. The avascular property of scarred palatal mucosa limits the process of appositional growth of bone which brings about descent of the palate.

e. The absence of the forward development of the upper arch owing to defective upper lip activity.

f. Soft-tissue interference with the forward development of the upper arch and forward displacement of the lower incisors may be caused by tongue action during deglutition.

g. The defective growth potential of the bone in cleft-palate patients.

THE INITIAL INFLUENCE OF THE LIP OPERATION

In the past, surgical thought has followed a policy of compression of cleft-palate segments together, even resorting to the use of clamps to achieve this end. This method was based upon the erroneous idea that the maxilla in cleft palate was wider than normal and that the cleft was in all cases the simple failure in union of well-developed segments. It is known that surgical closure of the cleft lip will bring about in turn a closure of the cleft between the anterior alveolar portions of the upper jaw (*Fig.* 2). This movement is the reverse of the lateral displacement which occurred before operation and is the result of rotation about a fulcrum, probably in the region of the maxillo-zygomatic suture.

The movement is due at this stage not so much to the tightness of the lip tissue as to the action of the lip muscle upon two unstable mobile segments of bone which do not appose to one another in the midline. The contact anteriorly of these two segments when it occurs achieves a temporary state of balance. The smaller unattached segment usually moves the greater distance medially until it rests against the larger segment. The arch thus becomes narrow, probably because the greatest pressure is exerted in the region of the modiolus of the lip.

This response, which is the common one, is not always seen and even at this stage it is possible to discern two different types of response to the action of the lips. The different response arises where the pressure appears to

be anterior. An excellent profile of a child at 18 months who had a lip operation at 2–3 months of age is seen in *Fig.* 3. The lip, however, is thick, with scar tissue attached high on alveolus, and a palatal displacement has occurred of the teeth and anterior part of the arch. The incisor teeth are in prenormal occlusion (*Fig.* 4). The lesser segment has not been displaced as far medially. The upper arch is short anteroposteriorly and wide

Fig. 3.—Excellent profile result at age of 18 months, following lip operation at age of 2 months.

laterally. The different arch form may be brought about by an excess local pressure acting upon the anterior part of the upper jaw.

THE VARIATION OF THE NASAL SEPTUM

Brash (1924) quotes experiments performed by both Fick and Landsberger. They found that the removal of a section of the anterior part of the nasal septum in young animals resulted in an abnormal upward growth of the snout in each case.

THE EFFECT OF PATHOLOGY ON THE NASAL REGION

A child, who at the age of 3 years sustained severe burns of the nasal region, shows a marked defect in the forward development of the arch. She had a rhinoplasty at the age of 11 years which involved the nasal septum. This injury, which was localized, has resulted in a gross facial and dental deformity by the

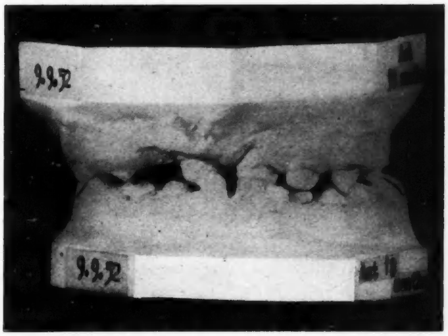


Fig. 4.—Models show condition immediately before palate operation at age of 18 months. Note backward displacement of upper incisors, but good arch width.

age of 17 years. A lateral skull X-ray of this patient is shown in *Fig.* 5.

Two patients who had irradiation treatment for a hæmangioma in the nasal area, one at

Fig. 5.—Lateral X-ray of patient, aged 17 years, who sustained severe burns in nasal area when 3 years old. (*By courtesy of Mr. N. L. Rowe, Plastic and Maxillo-facial Unit, Rooksdown House, Basingstoke.*)

2 years and the other during the first year of life, were examined. Both of these patients showed gross facial and dental deformity due

to the deleterious effect of the irradiation treatment upon the downward and forward development of the actively growing bone in and around the upper arch.

The nasal septum is very sensitive to any change in its environment or to any interference with its structures. This may result

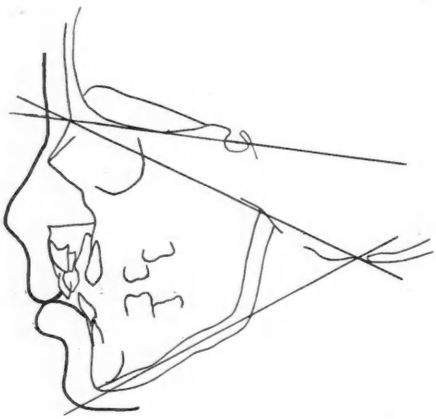


Fig. 6.—Tracing of lateral skull X-ray of child, aged 3 years 6 months, with bilateral complete cleft lip and palate. The vomer bone was not sectioned at operation.

in a failure of growth, as we have seen, or in an overgrowth of the septum.

OVERGROWTH OF NASAL SEPTUM DUE TO CHANGE IN ITS ENVIRONMENTAL PRESSURE

A child born with a complete bilateral cleft lip and palate shows a forward and upward projection of the prolabium. This is probably due to the loss of the normal restraining influence of a complete upper jaw and lip. An exaggerated growth occurs in the vomer bone.

The septal response to a unilateral complete cleft of the lip and palate is different. The nasal septum is attached to the unaffected side but undergoes rapid growth in a medial direction towards the affected side. This response may be due to asymmetry of pressure between actively growing arch segments and the nasal septum. Both of these conditions illustrate an exaggeration of vomer bone growth resulting from a release of environmental pressures.

THE RESPONSE TO OPERATIVE PROCEDURES ON THE NASAL SEPTUM

The extreme sensitivity of the nasal septum to any change results in a considerable variation of its response to different operative procedures.

a. **No Interference with Vomer Bone.**—In bimaxillary cleft lip and palate the initial operation effects a closure of the lip in front of the displaced prolabium. The vomer bone is not sectioned. The result of this operation is a gradual backward traction of the projecting tissue so that some restraint is offered to the forward growth of this part. A tracing from a lateral skull X-ray of this child shows the prolabium held forwards upon a stalk-like vomer bone. It is completely disassociated from the two maxillary segments (*Fig.* 6). The models show the downward and forward projection of the upper incisors giving rise to a marked incisal overlap. This is a favourable condition for a cleft-palate child. The buccal

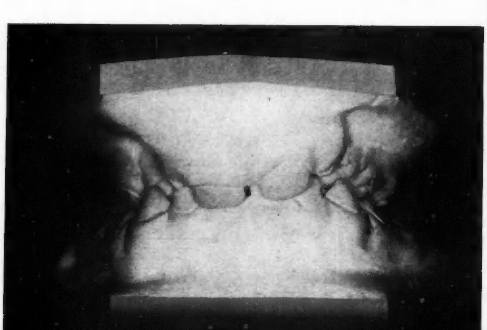


Fig. 7.—Models of same patient, showing deep incisor overlap.

segments have moved into linguo-occlusion (*Fig.* 7). The medial displacement of the buccal segments is due to muscular activity in the modiolar region. The arch is long anteroposteriorly and narrow laterally. The anterior segment is supported in a forward position.

b. **The Removal of a Section from the Vomer Bone.**—Some surgeons remove a section from the vomer bone to facilitate the backward displacement of the prolabium. While an initial advantage may be gained, this results in a failure of the vertical growth of the anterior segment. Backward displacement of the segment by the lip occurs and there is an apparent recession towards the base of the nose (*Fig.* 8).

c. **Removal of the Prolabium.**—Complete removal of the bone from the prolabium results in great deformity. The soft tissues of the structures are sometimes utilized to reconstruct the columella of the nose. There is a gross failure of the upper jaw to develop in all planes. The upper lip is thick and immobile. The upper arch has remained stationary in the face of active downward, forward, and lateral growth proceeding around it. The mandible is maintained in a resting posture by the soft tissue, which is relatively normal. This is made possible by a greatly increased free-way space. The tongue is usually postured forwards against the upper lip. Graber (1949) has demonstrated a marked increase in the free-way space as growth of the face takes place.

THE SUTURES WHICH INFLUENCE THE DOWNWARD AND FORWARD GROWTH OF THE FACE

Weinman and Sicher (1947) have shown the parallel arrangement of the suture lines concerned with the downward and forward growth of the face. They are the fronto-maxillary, the pterygo-palatine, the zygomatico-maxillary, and the zygomatico-temporal sutures. Growth activity continues until about 20 years of age. The pterygo-palatine suture is the only one which is likely to be affected by the palatine operation. The suture line between the sphenoid bone and the vomer is parallel to the other four suture lines. Brash (1924) did not consider that this structure contributed in any important degree to the downward and forward growth of the normal upper arch. The variation of its effect in cleft lip and palate is marked and this region merits further investigation.

THE TIMING OF THE OPERATION ON THE PALATE

The cleft-palate individual makes a double impact upon the outside world, through speech and appearance. They are placed in that order

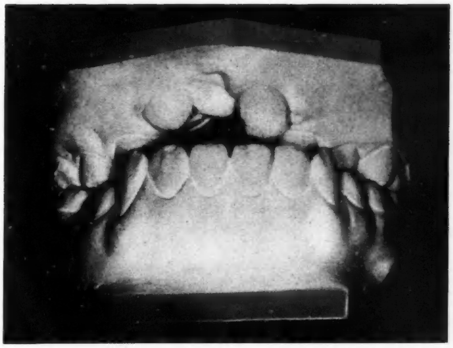


Fig. 8.—Models of patient, aged 17 years, with bilateral complete cleft lip and palate. Lack of forward and downward projection of prolabium following section of vomer bone at early operation.

of priority with the proviso that the appearance can be improved by orthodontics and retained by prosthesis.

The generally accepted rule in this country is to operate on the palate at about 2 years of age. There is considerable controversy about the timing of this operation. Dorrance (1933) considers that 5 years is the ideal age and Graber (1949) has said that surgical closure of the palate should be postponed at least until the fourth year of life.

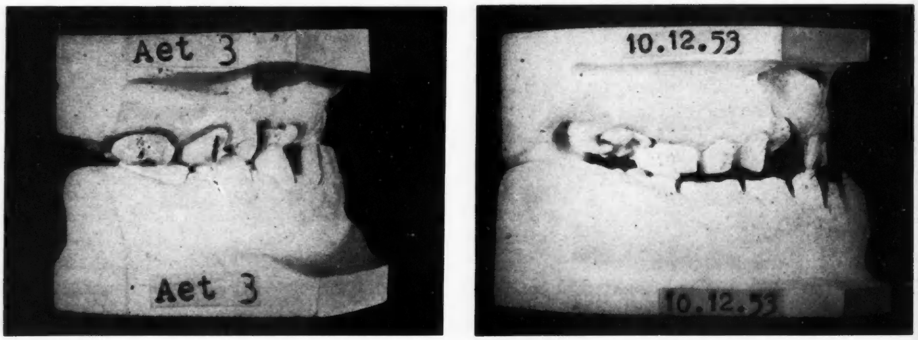
The sutures which are open at the age of 4 are as follows: The medial-palatal, the premaxillo-maxillary, the transverse-palatine, and the pterygo-palatine sutures. Cartilaginous junctions are present between the basi-occiput and the sphenoid bone and also at the occipital condyle. The initial cleft palate involves the median-palatal and the premaxillo-maxillary sutures. The mucoperiosteum is stripped from the transverse palatine and the pterygo-palatine sutures during the palate operation. The palatal tissue is also elevated from the bone surface. Both Brash (1924) and Todd (1931) have shown from work on normal skeletal material that five-sixths of the total

maxillary width has been completed by the fifth year and the entire lateral width by the tenth year.

Brash showed that the length of the palate doubles itself in the course of growth from birth to 20 years of age. Two-fifths of this growth takes place between birth and the fourth year. A comparison of skulls at birth and at 4 years demonstrates that the main change which occurs is the formation of alveolar bone to accommodate the erupting teeth. Clinically it is found that the first marked deterioration towards deformity occurs in the 5 to 7-year age-group. A rapid change in incisor and molar relationship towards pre-normal occlusion may occur at this time. These changes would be associated with a deficient downward and forward growth of the upper arch. During and after the eruption of the first permanent molars a rapid increase in palatal length occurs in the normal. The transverse palatal suture maintains a constant relationship mesial to the newly erupting permanent molars during this growth phase. There is a proportional increase in both the palatal process of the maxilla and the palatine bones. Professor Wood-Jones (1946) has stated that the distance between the posterior nasal spine and the posterior wall of the pharynx is constant throughout life. Active bone growth at the cartilaginous junction of the basi-occiput and the sphenoid bone results in a considerable forward projection of the bones of the face.

The transverse palatine and pterygo-maxillary sutures are in a state of great activity as the anteroposterior length of the upper jaw is increased. The condylar suture which is partly concerned with the compensating growth of the base of the skull, closes after eruption of the first permanent upper molars.

A similar picture of growth activity is seen in the upper jaw between the age of 9 and 12 years. A great increase in size occurs at about the age of 10 years. The transverse palatine suture is seen to be mesial to the newly erupting second permanent molars.



A B

Fig. 9.—A, Models of patient at age of 3 years, showing cheek teeth relationship. B, Same patient at 7 years, showing lack of forward projection of upper arch and marked deterioration in cheek teeth relationship.

The growth centres which influence the zygomatico-maxillary buttress apart from the median palatal suture are not affected by the palatal defect. It is not surprising, therefore, to find that the width between the molars is relatively normal. This may also be due partly to a release of medial pressure exerted by the tendon of the tensor palatii muscle which passes around the hammular process. This process is often fractured to allow for a decrease of tension in the soft palate.

In the face of this evidence it would appear that the choice of a late palate operation at 5 years of age may involve the growth centres in gross disturbance at the time that they are most active.

EFFECT OF THE PALATE OPERATION

The patients with incomplete cleft of the hard and soft palate alone appear to experience difficulty in speech development. A great proportion of them develop fistulæ of the palate. These two factors may be indications of the tension set up after the palate operation where there is no compensating movement of the arch segments as in complete cleft of the palate. Deformity of the arch and poor speech can usually be related to the amount of scar tissue present and to a history of repeated operations usually for a closure of fistulæ of the palate.

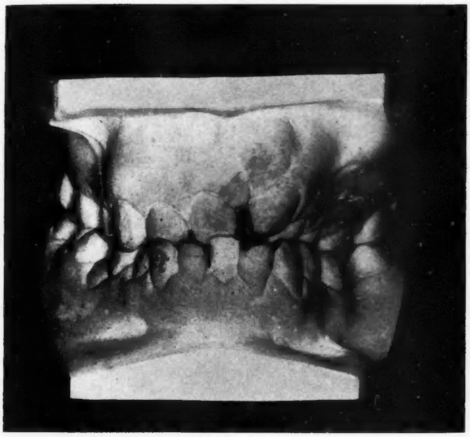


Fig. 10.—Patient with complete unilateral cleft lip and palate. No operation on palate. Deformity following lip operation at early age.

The models shown in *Fig.* 9, A of a patient with complete unilateral cleft lip and palate show that the arch relation at the age of 3 is relatively normal. A thick immobile lip has displaced the temporary upper incisor teeth inside the lowers.

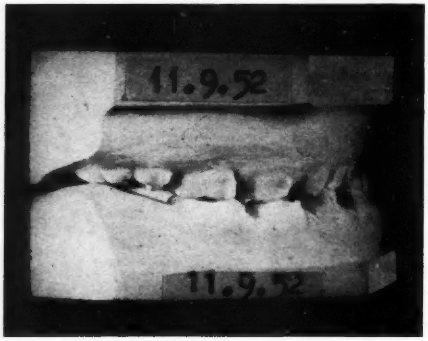
Fig. 9, B shows the same patient at the age of 7 years. A marked defect in the forward projection of the cheek teeth has occurred. The incisal relationship has also undergone a marked deterioration, probably as the direct result of the palate operation upon sutural growth. The relation between the degree of deformity and history of operations together with the amount of scar tissue laid down, requires careful investigation.

A comparison of two patients with unilateral complete cleft lip and palate will be considered. One of these patients had a lip operation only and no palate operation. The changes at the anterior part of the arch due to the influence of the lips can be seen, but the arch segments have developed relatively well (*Fig.* 10). The other patient had an operation on the lip but had a long series of palate operations (*Fig.* 11). The deformity seen is probably partly the result of active interference with the growth sutures influencing the palate, but the other important factor to be considered is the avascular property of the scar tissue covering the palate. Bone growth requires a plentiful blood-supply, which is lacking under these conditions. The descent of the palate in line with the growth of the other structures is brought about by a process of resorption and deposition of bone in the palate. An arrest of this process may be due to the poor blood-supply of heavily scarred palatal mucosa. A further contributory factor may be the division of the main vessels of the palate during operation. An upper arch which has not descended to its normal position will be deficient in all dimensions. The marked irregularity of the teeth is more likely to be due to this factor than to the pull of scar tissue.

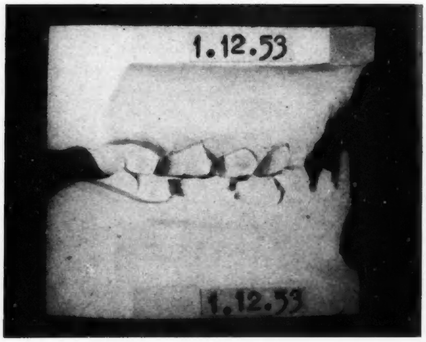
Fig. 11.—Patient with complete unilateral cleft lip and palate. Deformity following early lip operation and series of operations on palate.

THE INFLUENCE OF THE LIPS

The immediate result from the lip operation may be very pleasing. A normal baby has a fullness of the upper lip, and although good lips are seen after operation, this fullness is usually lost in the cleft-lip patient. As the child grows there is noticed an increasing discrepancy in the upper lip, which in proportion to the remainder of the face does not appear to develop at the same rate. The inequality of the lips and their muscular activity is reflected in the arch formation.

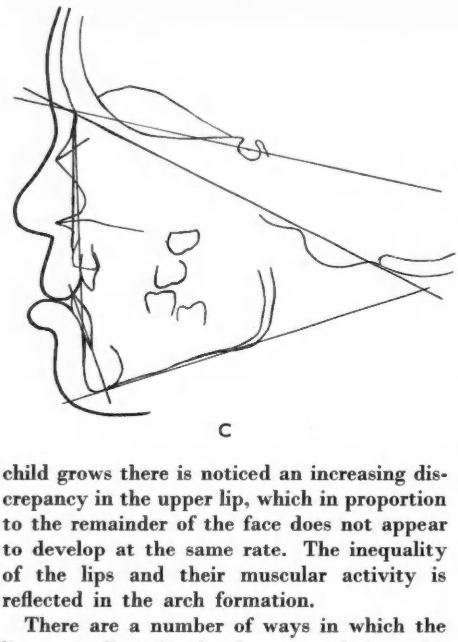


A



B

Fig. 12.—A, Arch relationship at age of 6 years in patient with unilateral complete cleft lip and palate. B, Deterioration in arch relationship in one year during change-over from temporary dentition to permanent dentition. C, Tracing of lateral skull X-ray of above patient. Adverse lip posture associated with reversed tongue action during deglutition.



C

There are a number of ways in which the lip may affect the development of the arch: (*a*) A local displacement of teeth; (*b*) Changes in the incisal relationship; (*c*) It may exert a mechanical barrier to the forward translation of the upper arch.

The upper lip may be deficient in size owing to the agenesis of lip tissue. The incisal relationship is so affected that any influence the mandible might have exerted upon the forward growth of the maxilla is lost. Such a lip is usually thick and immobile, so that the lower lip is hyperactive and used during speech.

Another important change occurs under these conditions. The usual tongue to lower lip swallowing pattern, as described by Rix (1952), is reversed so that the muscle play takes place between the tongue and upper lip. The effect of this forward and upward thrusting action of the tongue is to protrude the lower incisors and retract the upper incisors. An added deformity may occur in the absence of some incisal teeth.

When segments of bone are under compression from muscle forces their size in the alveolar region is largely determined by the number of teeth present. In partial anodontia the lip and tongue action is capable of projecting the anterior segment distally, especially in bimaxillary cleft of lip and palate. Conversely, the presence of several

supernumerary teeth may have the beneficial effect of maintaining the anterior part of the arch in a forward position.

THE ORTHODONTIC PROBLEM

It has already been stated that the upper arch deformity in unilateral complete cleft lip and palate may assume two different patterns.

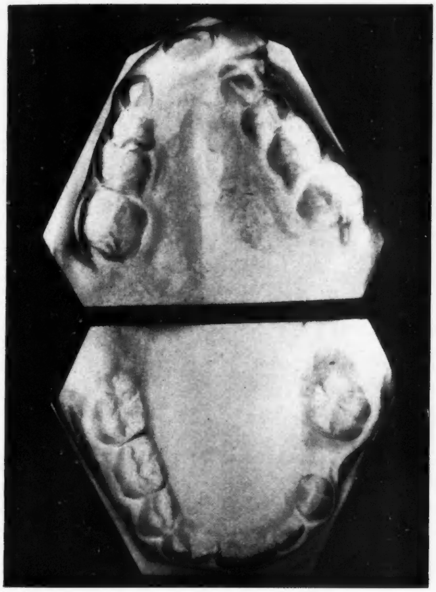
The one unfavourable type occurs where the upper arch is short anteroposteriorly and wide laterally owing to excessive backward displacement by the lip in the incisal region during the early stages of arch development. This displacement occurs when the repaired lip becomes immobile, thick, and tense in posture. The lower lip under these conditions is usually loose and very mobile.

The change-over in the dentition from the temporary incisors to the permanent teeth is often accompanied by an increase in the deformity of the incisor relationship. *Fig.* 12, A, B shows the change which has occurred in one year. There has been a deterioration in both the molar and incisor relationship. The tracing from a lateral skull X-ray shows the abnormal posture of the soft tissue (*Fig.* 12, C). The lower incisors have been displaced forwards by the action of the tongue during deglutition. The interaction between the tongue and the thick upper lip causes a recession of the upper incisors.

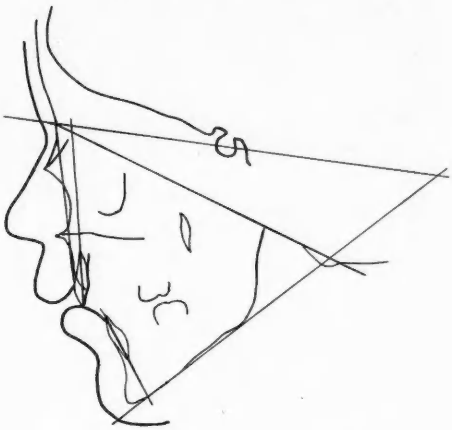
These movements are atypical and occur during the tooth-apart swallow which is common to all cleft-palate patients.

The favourable type of patient with unilateral complete cleft lip and palate shows a facial pattern which is more normal in appearance. The upper lip is postured forwards, is normal in thickness, is relatively mobile and shows little tendency towards tightness. The development of the upper arch shows a characteristic form which is long anteroposteriorly and narrow laterally (*Fig.* 13, A). The medial displacement of the lesser segment, which is more marked in these cases, may play some part in holding the anterior part of the larger segment in a forward position.

The X-ray tracing (*Fig.* 13, B) shows that the posture of the lips is relatively normal and that during deglutition a typical tooth-apart swallowing action is performed. This



A



B

Fig. 13.—A, Favourable deformity associated with unilateral complete cleft lip and palate. Upper arch long anteroposteriorly and narrow laterally. B, Tracing shows favourable balance between lip and upper incisors.

muscular action probably plays an important part in the maintenance of the incisor relationship, especially during the transition period from the temporary incisor teeth to the permanent dentition.

The same two distinct patterns of arch development are found in patients with complete bilateral cleft lip and palate. The tendency towards arch deformity is always more marked in these cases. The influence of the anterior pressure from the lip in the unfavourable type causes a gross backward displacement of the separate premaxillary element. The size of this anterior segment and the number of teeth present will influence the amount of movement. The excessive lip pressures are also liable to produce a more marked medial rotation of the two buccal segments (*Fig.* 14, A).

The favourable arch form in complete bilateral cleft lip and palate is long anteroposteriorly because the premaxillary segment is maintained in a forward position. There is a marked medial deflection of both buccal segments until they move into contact with the anterior segment (*Fig.* 14, B).

The most marked facial and arch deformity occurs when the bony element is removed from the prolabium. The result is a complete medial collapse of the anterior ends of the two buccal segments until they assume a state of rest in contact with one another. The result is a very short upper arch, although the molar width remains relatively normal (*Fig.* 14, C).

Graber (1949) found as the result of his investigations into cleft-palate deformity that:—

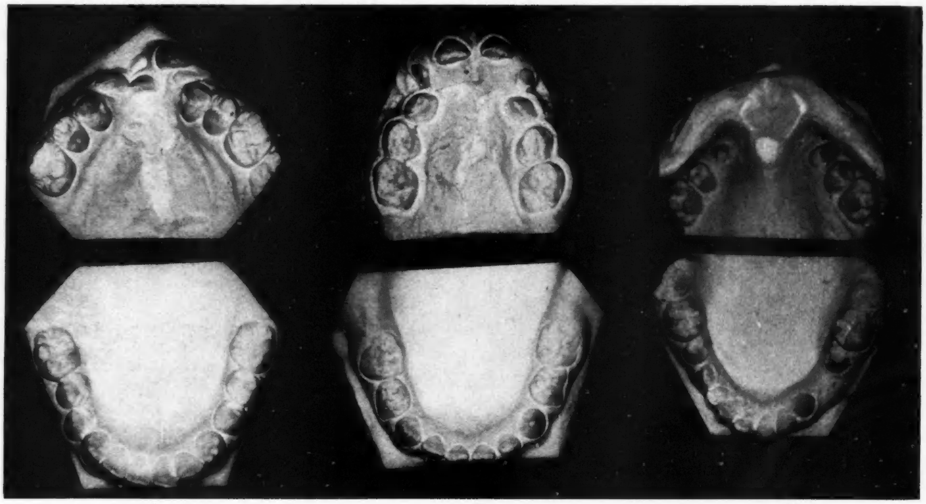
a. The maxillary height is less than normal.

b. The free-way space is greater than normal. An average of 7·2 mm. was found with a range existing between 1 mm. and 20 mm.

c. The angle of convexity, or N.A.P. angle, was less, giving rise to the typical deficient middle-third appearance of these patients.

d. The angle formed by the nasion, sella turcica, and upper first permanent molar was greater than in the normal. This was due to lack of forward translation of the upper arch.

e. The angle S.N.A. was less, showing the probable influence of the upper lip in its retarding action on the forward movement of the anterior part of the upper arch.



A B C

Fig. 14.—A, Short anteroposterior dimension of upper arch. Unfavourable type. B, Favourable type. Long anteroposterior upper arch. C, Gross medial rotation of buccal segments following removal of prolabium.

f. The angle between the lower incisor and mandibular plane is almost invariably less than a right angle.

The hereditary pattern which cleft-palate children assume may be Angle's Class I, II, or III. Graber found that the mandible is on an average slightly underdeveloped in relation to the cranial base.

CONCLUSION

The effect of cleft lip and palate and of subsequent operations upon the growth and development of the jaws has been reviewed. The influence peculiar to each factor has been considered, particularly in its effect on cases of unilateral complete cleft lip and palate. The variation in other groups is mainly one of degree.

The material has been obtained from the investigation of 60 cases, with an age range of 3 months to 20 years, who are suffering from varying degrees of lip and palate defect.

The following conclusions may be drawn from these investigations:—

1. Delay of the lip operation in complete unilateral cleft lip to 6 months or even 1 year will have a beneficial effect upon the forward displacement of the upper arch.

2. The nasal septum should be kept as free from surgical interference as possible. In complete bilateral cleft lip and palate the displaced prolabium may be moved back by traction and never by removal of a section of the vomer.

3. The primary palate operation can be performed as early as is practical and secondary operations which will increase scar tissue reduced to a minimum.

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NATIONAL INSURANCE

Blue National Insurance cards expire on Sept. 4.

The Ministry of Pensions and National Insurance reminds employers and insured persons holding these cards that they should be exchanged for the new yellow ones at a local Pensions and National Insurance Office as early as possible between Sept. 6 and Sept. 11. Each card should bear the full up-to-date address of the contributor.

Mouth-breathing

"Defective nose-breathing in a child may be due to a cause within the nasal cavity itself, to excessive lymphoid tissues in the post-nasal space (adenoids), or to habit.

"It is customary to attribute any nasal symptoms in a child to adenoids, just as it is usual to attribute such symptoms in an adult to 'catarrh'. In both cases a proper examination of the nose after a careful history has been taken should be the rule. In not a few instances it will be found that the nasal obstruction is variable, possibly being worse in the morning on rising, and then an allergic cause should be considered. If the possibility of allergy has been excluded, and enlarged tonsils and adenoids have been removed, and the nasal airway seems clear, then the possibility of habit must be considered. Children who have of necessity been habitual mouth-breathers acquire a pattern of mouth-breathing which is continued even when the nasal airway has been restored. For these, breathing exercises are needed.

"In some there may be a dental malformation which requires correction, and in very persistent mouth-breathers who have a good nasal airway it may be necessary to prescribe an obturator for wearing at night."—"Any Questions?" (1954), *Brit. med. J.*, **1**, 285.

ABSTRACTS
from Other Journals

Changes in the Lamina Dura during Tooth Movement

Changes in the roentgenographic appearance of the lamina dura during various types of tooth movements such as occurs during eruption, drifting, and orthodontic procedures are described.

During the stages of active eruption the density of the lamina dura was as great as the much thicker and more highly calcified dentine in the same film. As the tooth achieved full clinical occlusion and the rate of eruption slowed down, the lamina dura became thinner and much less radiopaque.

During the period of tooth movement the lamina dura became distinctly wider and more radiopaque on the side of tension and disappeared on the side of pressure. The periodontal membrane at the same time became distinctly wider on the side of tension and very thin on the side of pressure. The roentgenographic picture of the lamina dura tends to become reversed during the retention period, but indicates again, clearly, the area of new bone formation.

Histological analysis showed that the newly formed bone on the periodontal surface of the alveolar bone proper, which is deposited during tooth eruption, mesial drift, and orthodontic tooth movement, is fibrous in nature. This fibrous bone soon becomes reorganized into lamellar bone.—Massler, Maury (1954), *Amer. J. Orthodont.*, **40**, 364.

The Growth and Function of the Muscles of Mastication in relation to the Development of the Facial Skeleton and of the Dentition

An extensive review of the literature is undertaken to gather together what is known about the growth and development of muscle, the relation between muscle growth and the form and structure of bone, with special reference to the muscles of mastication, the bony skeleton of the face and cranium, and the development of the dentition.

It is postulated that growth of the muscles is regulated by nerve reflexes developing in association with the development of the dentition, and in this way the specialized muscle actions found in different animals are related to their specialized dentitions on the one hand, and to specializations in the structure and form of certain regions of the skull on the other.—Scott, J. H. (1954), *Amer. J. Orthodont.*, **40**, 429.